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Article

Before and After the COVID-19 Pandemic Measures in a Chinese Medical University: Evaluating the Impact of the Pandemic Policies on International Medical Students in Mainland China

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Abstract: The COVID-19 pandemic measures have negatively impacted education worldwide via travel restrictions, student visas, and physical attendance among many other factors. As one of the first places to impose strict pandemic measures and one of the last places to lift the measures, Mainland China provided a unique venue to investigate the effect of public health pandemic control policies on tertiary education. Considering the large portion of international students in medical schools and the higher susceptibility to the pandemic measures due to the natural synergy with teaching hospitals, medical schools can be an early forefront indicator of the impact of the pandemic on tertiary education. We surveyed 513 participants international medical students from Wenzhou Medical University's school of international studies in 2019 and 2022 about their satisfaction and demographic and cultural adaptation parameters. We found that the pandemic restrictions did not generally impact student satisfaction. Further analyzing the associated parameters, we found teaching satisfaction to be independent of age ($P=.159$), years in China ($P=.896$) and Chinese Level ($P=.577$) in the medical university. Teaching satisfaction is associated with the region of origin ($P <0.001$), acceptance of local social norms ($P <0.001$), satisfaction with the core values of Chinese culture ($P <0.001$), acclimatization to life in China ($P <0.001$), can easily make Chinese friends ($P <0.001$) among other factors. The findings of this study provide an understanding of the effects of pandemic measures on tertiary education satisfaction and other factors that can aid in international student satisfaction.

Keywords: teaching quality; international Students; teaching satisfaction; Chinese language; medical students; COVID-19 pandemic measures

1. Introduction

The number of international students in China reached 0.44 million in 2016, with over 442,773 international students from 205 different countries studying in 829 universities and institutions in Mainland China[1]. Apart from learning languages as non-degree students, almost half of the international students were involved in degree study [2]. In an educational hub, the study environment must be conducive for international students.

With the COVID-19 pandemic affecting the world between 2019 and 2022, many measures may have compromised meeting the needs of tertiary students, particularly the

acquisition of practical skills. While there have been effective measures to compensate for the lack of face-to-face physical classes, such as video teaching [3], the pandemic measures' notable negative impact on student performance [4] that may be projected and reflected in the satisfaction with tertiary education. To offset and mitigate the already present negative impact, external environmental factors ought to be investigated to improve the well-being of students [5] to prevent psychological stress to physiological stress [6, 7].

Through satisfaction surveys initially implemented in customer-oriented companies, universities also began to evaluate their student-orientated education⁷. The importance of satisfaction, particularly in life satisfaction, is associated with perceived stress and mental and physical well-being [7]. Satisfaction within a job was linked to motivation [8] and self-efficacy, playing a possible role in the "Great Resignation" observed during the COVID-19 pandemic in many countries. With perceived social support promoting better mental well-being [5], it is likely an important pull factor in the international students' settling in and social adaptation that directly impacts mental health.

The importance of mental health shown during the COVID-19 pandemic is a double-edged sword, revealing the pandemic to be a unique time period to study the factors on mental well-being and the push and pull factors involved in the development of an education hub. Factors such as social adaptation to the local culture and social norms apart from the perceived teaching quality as teaching satisfaction could be investigated in their susceptibility to public health policies. Identifying more robust factors (e.g. food culture [9, 10]) may thus allow future interventions to mitigate the impact of public health infection control measures.

This study thus aims to identify the factors affecting students' satisfaction and teaching quality among international students in Mainland China, making comparisons of cohorts before and during the pandemic that would be relevant for tertiary education satisfaction globally.

2. Materials and Methods

2.1. Design

This study utilized a cross-sectional design; the students were all from Wenzhou Medical University. The study participants were randomly recruited from the international student population at Wenzhou Medical University anonymously through electronic email. The study was deemed low-risk and exempted by the Wenzhou Medical University ethics board. A total of 513 participants, 258 (126 males and 132 females) in 2019 and 255 (126 males and 129 females) in 2022 students, were surveyed using a set of satisfaction questions (Appendix A) and recruited through the university email system. The country of origin of the participants' regions is shown in Table 1.

2.2. Measures and Procedure

The participants answered a 21-item survey (Appendix A), and the responses were keyed into Microsoft Excel. The survey questions covered gender, age, years spent in China, Chinese proficiency levels, and perceptions about the social and cultural aspects of their lives in China, as well as their satisfaction with teaching and university life. The students completed the survey anonymously after a verbal briefing and had the freedom to withdraw at any time without prejudice. There were no incentives provided, and no identifiable and personal information collected.

2.3. Data Analysis

The data was analysed using the IBM Statistical Package for Social Sciences (SPSS) version 26.0. All tests conducted were two-tailed, $\alpha = .05$. We ran Multinomial Logistic Regression on the variables (gender, age, region, how many years they have lived in China, Chinese Level, time and the nominal questions reflecting their satisfaction with China's satisfaction) to test for the differences before and during the pandemic.

Satisfaction with the teaching quality was designated the independent variable, while the level of Chinese proficiency and years spent in China were dependent variables for the crosstabulation lambda analysis. Data collected from the two different time periods were analyzed using frequency analysis, multinomial logistic regression and factor analysis.

Table 1. The regional demographics of the participants

Region	Number of Participants
Others	2 (0.4%)
South Asia	209 (40.7%)
Southwest Asia	59 (11.5%)
East Africa	14 (2.7%)
Caribbean	50 (9.7%)
Southwestern Europe	4 (0.8%)
Persian Gulf	42 (8.2%)
Horn of Africa	2 (0.4%)
North Africa	76 (14.8%)
Southeast Asia	2 (0.4%)
South-western Pacific	21 (4.1%)
Central Asia	14 (2.7%)
Southern Africa	8 (1.6%)
Oceania	2 (0.4%)

3. Results

Descriptive Statistics

Normality of variances (age and how many years the participants had been in China) assumptions were violated as indicated by Shapiro-Wilk's and Kolmogorov-Smirnov's tests, and thus non-parametric tests were used. FrequencyAnalysis (Table 2) did not show any significant differences between the variables from the two different time periods of pre- and during the COVID-19 pandemic.

Table 2. Frequency differences between the 2019 and 2022 cohort

	The demographics of the participants	
	2019	2022
Chinese Proficiency Level	1	55 (21.3%)
	2	85 (32.9%)
	3	24 (9.3%)
	4	45 (17.4%)
	5	49 (19.0%)
Appreciate Chinese traditional holidays.	Yes	246 (95.3%)
	No	12 (4.7%)
Finding China's 5000 years of history to amazing	Yes	247 (95.7%)
	No	11 (4.3%)
Wish to have more Chinese courses	Yes	204 (79.1%)
	No	54 (20.9%)
Appreciative of the core values of Chinese culture	Yes	247 (95.7%)
	No	11 (4.3%)
Accepting Chinese behavior norms	Yes	214 (82.9%)
	No	44 (17.1%)
Acclimated to life in China	Yes	225 (87.2%)
	No	33 (12.8%)
Can easily make Chinese friends	Yes	196 (76.0%)
	No	62 (24.0%)
Willing to attend activities with Chinese students	Yes	247 (95.7%)
	No	11 (4.3%)
Satisfied with the public security on campus	Yes	235 (91.1%)
	No	23 (8.9%)
University respects and cares about the international students	Yes	194 (75.2%)
	No	64 (24.8%)
University responses to international students' advice or complaints quickly and effectively	Yes	166 (64.3%)
	No	92 (35.7%)
University's support and assistance for international students are sufficient.	Yes	176 (68.2%)
	No	82 (31.8%)
University's management is human-biased and efficient.	Yes	203 (78.7%)
	No	55 (21.3%)
Satisfied with the teaching level	Yes	182 (70.5%)
	No	76 (29.5%)
Satisfied with the teaching materials used in class	Yes	180 (69.8%)
	No	78 (30.2%)
Satisfied with the teaching methods applied by teachers	Yes	184 (71.3%)
	No	74 (28.7%)
Satisfied with the teaching quality	Yes	188 (72.9%)
		185 (72.5%)

	No	70 (27.1%)	70 (27.5%)
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Table 3. Factor Analysis

		Factors		
	Satis-faction	Chinese culture	Chinese his-tory & soci-ety	Demographics
Satisfied with the teaching quality	0.860			
Satisfied with the teaching methods applied by teachers	0.854			
Satisfied with the teaching level	0.830			
Satisfied with the teaching materials used in class	0.782			
Acclimated to life in China	0.722			
Appreciative of the core values of Chinese culture	0.698			
Willing to attend activities with Chinese students	0.667			
Appreciate Chinese traditional holidays.	0.641			
Accepting Chinese behavior norms	0.581	0.421		
Finding China's 5000 years of history to amazing	0.527	0.302		
Can easily make Chinese friends	0.402	0.514		
Satisfied with the public security on campus	0.443	0.343		
University responses to international students' ad-vice or complaints quickly and effectively		0.775		
University's support and assistance for interna-tional students are sufficient	0.395	0.705		
University respects and cares about international students	0.424	0.663		
University's management is human-biased and effi-cient	0.388	0.609		
Years in China		0.748		
Region		0.686		
Chinese Proficiency Level			0.783	
Age			0.486	-0.577
Gender				0.69
				3

Wish to have more Chinese courses	0.303	0.335	0.59
Rotation converged in 9 iterations.			4

Factor Analysis (Tihomir & Bengt, 2021) was also performed and shown in Table 3 to reveal that satisfaction, teaching quality, teaching level, teaching methods and teaching materials were in the same dimension. The various factors are shown in Table 3, with the fourth to sixth factors combined as demographics.

Cross-Tabulation Lambda Analysis

Cross-tabulation Lambda analysis showed that all other variables except for 'age' had a significant correlation with the satisfaction of general teaching (Table 4)

Table 6. Cross-Tabulation Lambda Analysis

Independent Variable	Dependent Variable
	Satisfied with the teaching quality
Gender	.013**
Region	.124**
Age	.010
Enjoy the Chinese traditional holiday	.56**
Amazed by China's 5000 years of story	.047**
Wish to have more Chinese courses	.110**
Appreciative of the core values of Chinese culture	.047**
Accepting Chinese behavior norms	.078**
Acclimated to life in China	.055**
Can easily make Chinese friends	.139**
Willing to attend activities with Chinese students	.067**
Satisfied with the public security on campus	.056**
University respects and cares about international students.	.338**
University responses to international student advice or complaints quickly and effectively	.209**
University's support and assistance for international students are sufficient	.292**
University's management is human-biased and efficient.	.284**
Satisfied with the teaching level	.656**
Satisfied with the teaching materials used in class	.441**
Satisfied with the teaching methods applied by teachers	.652**

*denotes $p<0.05$; ** $p<0.01$.

Satisfaction with the general teaching quality was not correlated with Chinese proficiency levels ($P=.577$) nor with years spent in China ($P=.896$).

Multinomial Logistic Regression was performed for gender, age, region, years spent living in China, Chinese proficiency, time period, and life in China. No significant correlations ($p>0.05$) were found between the pre-and during COVID-19 pandemic time periods with the other variable questions (Table 5).

Table 5. Multinomial Logistic Regression

Effect	Model Fitting Criteria -2 Log Likelihood of Re- duced Model	Likelihood Ratio Tests		
		Chi-Square	df	Sig (P)
Intercept	331.838 ^a	0	0	.
Gender	331.861	0.022	1	0.882
Region	331.916	0.077	15	1
Age	331.845	0.007	3	1
Years in China	331.876	0.038	6	1
Chinese Level	331.869	0.03	4	1
Like Chinese traditional holiday	331.844	0.006	1	0.94
Finding China's 5000 years of history to amazing	331.838	0	1	0.998
Wish to have more Chinese courses	331.839	0.001	1	0.981
Appreciative of the core values of Chi- nese culture	331.839	0	1	0.99
Accepting Chinese behavior norms	331.839	0	1	0.992
Acclimated to life in China	331.839	0.001	1	0.98
Can easily make Chinese friends	331.855	0.016	1	0.898
Willing to attend activities with Chi- nese students	331.841	0.002	1	0.963
Satisfied with the public security on campus	331.839	0	1	0.99
University respects and cares about in- ternational students	331.847	0.008	1	0.928
University responses to international students' advice or complaints quickly and effectively	331.838	0	1	0.998
University's support and assistance for international students are sufficient	331.843	0.005	1	0.945
University's management is human-bi- ased and efficient	331.844	0.006	1	0.939
Satisfied with the teaching level	331.842	0.004	1	0.951
Satisfied with the teaching materials used in class	331.863	0.025	1	0.875
Satisfied with the teaching methods applied by teachers	331.854	0.016	1	0.9
Satisfied with the teaching quality	331.838	0	1	0.997

4. Discussion

As the hub of the private economy in Mainland China [11] and an aspiring international education hub, Wenzhou's rate of globalization would lag behind larger cities such as Shanghai, Shenzhen, and the capital Beijing. This may be experienced in the lower rate of English signage and speakers. Due to the pandemic having an extended impact in Mainland China being one of the first few countries to implement tight lockdown measures followed by being one of the last major countries to lift lockdown, Mainland China is a unique place to study the impact of lockdown public health policies on international education. Considering that the pandemic hit hospitals worldwide, the medical university was also a more susceptible teaching institution considering all of these factors [12-14]. Thus, this study provides a unique extreme insight into public health policies' impact on tertiary education in an extreme environment.

Factors affecting international students were investigated through a 21-item survey at Wenzhou Medical University before and after the COVID-19 pandemic. Factor analysis grouped our 21-item survey into six factors, with the last few variables combined into demographics as four factors. The four factors of satisfaction, Chinese culture, history and society, and demographics were found, serving as potential markers for establishing a Chinese education hub. It could be used for any aspiring global education hub with society adaptation into the corresponding culture and society of the respective locality.

With previous qualitative analysis [15] calling for a deeper analysis, we performed a more quantitative investigation, comparing the pre-and during the COVID-19 pandemic. Most participants showed good acclimatisation to the country and teaching environment, with some exceptions. The students were generally satisfied with the teaching quality and the university environment, as found in some other medical universities [16]. It should be noted that making friends was classified in factor analysis under both satisfaction and acclimatisation in the local culture, making this an important aspect of settling in. Despite the varying self-reported proficiency in the Chinese language of the participants, language proficiency had only a minimal impact on satisfaction in our study, probably because the students were taught in English medium. It should also be noted that the other societal and cultural variables were also not affected by the Chinese language proficiency on the whole, even though it is expected to have generally brought about some inconvenience in daily life communication and in a slightly less globalised city of Wenzhou.

The general acceptance of the culture and societal norms was expected since the medical education programme is longer than the typical language or degree programme. With the significant investment in both time and money, the students would have made some effort to fit in or at least finding out about the local culture [17], yet what was interesting was that some questions were shared with factors of acclimatisation and appreciating the Chinese history and societal norms. This was interesting, particularly the acceptance of societal norms during the pandemic.

Given the opportunity to compare cohort data before and during the pandemic, the lack of significant differences from the multinomial logistic regression suggested that the public health policies did not negatively impact the student's perception of education and the environment. While the occasional lockdowns caused many classes to switch to online delivery and teaching at times, there was no difference in the satisfaction of the teaching quality and content delivery. There was also no change before and during the pandemic in the participants' Chinese proficiency and willingness to acclimatise themselves. While speculative, this suggested that the measures did not severely impact their ability to socialise and that they could usually carry out most of their lives. The continued general willingness of the students to accept Chinese societal norms also indicated two possibilities. Firstly, either they could distinguish the special measures during the pandemic, or secondly, they accepted the actions of frequent testing and other infection control measures, a finding congruent with other medical schools [18]. And this acceptance would be so even as medical students spend part of their training in hospitals under stricter infection policies.

5. Limitations

The findings in our study are limited in that they can only reflect the Wenzhou Medical University and are not easily generalised to other medical schools or other types of tertiary training, and even to other cities given that the impact of the pandemic can vary from city to city and province to province, care must be taken in assuming that the impact of international students would be uniform across Mainland China. In addition, we acknowledge that our survey is limited in scope and serves only as a good starting point for further and future investigations into the more robust permanent factors for a successful educational hub. In addition, we were not able to investigate the impact of the online teaching during the pandemic in a more detailed level.

6. Conclusions

We found satisfaction with teaching quality fairly independent from acceptance of societal norms and acclimatisation. And despite the pandemic measures in extreme manner relative to global public health policies, there was general satisfaction with the teaching quality at Wenzhou Medical University. It should be noted that the ability to make friends was important for satisfaction and the students' acclimatisation. Future interventions to improve student satisfaction may be focused on this aspect.

Supplementary Materials:

Author Contributions: The following statements should be used "Conceptualization, W.S-X. and A.P.D-P.; methodology, WSX; A PDP, S S-X.; J. P-D; validation, Y. XP., Y.YX. and G. SKE.; formal analysis, J.P-D; G. SKE.; investigation, S.S-X; A. PDA.; resources, Y., T; Y.XP; Y, Y-X.; data curation, S. S-X; J. P-D; A. P-D-P.; writing—original draft preparation, G. SKE; A. P.D-P.; writing—review and editing, G. SKE.; visualization, J.P-D.; supervision, W.S; G. SKE, Y. X; Y.Y; project administration, W.S; A. P.D-P.; funding acquisition, W.SX, Y.T.

All authors have read and agreed to the published version of the manuscript." Please turn to the [CRediT taxonomy](#) for the term explanation. Authorship must be limited to those who have contributed substantially to the work reported.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study..

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A: Survey questions

- 1) Gender : Male or Female
- 2) Age: 19-23, 24-28,29-33, >34
- 3) Years in China: 1,2,3,4,5,6,7
- 4) Chinese Level: High , Medium, Low
- 5) Do you like Chinese traditional holidays? Yes or No
- 6) It is impressive that China has a history of 5000 years. Yes or No
- 7) I think the university must offer more courses on Chinese culture and modern China's introduction to international students. Yes or No
- 8) I agree about the core values of Chinese culture, such as 'prioritising harmony' Yes or No

- 9) I could accept most Chinese behavior norms. Yes or No
- 10) I acclimated myself to life in China. Yes or No
- 11) I could easily make new friends with Chinese students. Yes or No
- 12) I am willing to attend activities with Chinese students. Yes or No
- 13) I am satisfied with the public security on campus. Yes or No
- 14) University puts students first (respect international students and care about international students) Yes or No
- 15) University's responses to international students' advice or complaints are quick and effective Yes or No
- 16) University's support and assistance for international students are sufficient? Yes or No
- 17) University's management is human-biased and efficient. Yes or No
- 18) I am satisfied with the level of teaching. Yes or No
- 19) I am satisfied with the teaching materials used in class Yes or No
- 20) I am satisfied with the teaching methods applied by teachers. Yes or No
- 21) I am satisfied with the general teaching quality. Yes or No

References

1. Botha, W., *English and international students in China today: A sociolinguistic study of English-medium degree programs at a major Chinese university*. English Today, 2016. **32**(1): p. 41-47.
2. Yojana Sharma. CHINA: Top students opt for Hong Kong. 2011; Available from: <https://www.universityworldnews.com/post.php?story=20110721101613344>.
3. Heng, Z.S.L., et al., *Effects of different delivery modes on teaching biomedical science practical skills in higher education during the 2021 pandemic measures*. Biochemistry and Molecular Biology Education, 2022. **50**(4): p. 403-413.
4. Hammerstein, S., et al., *Effects of COVID-19-Related School Closures on Student Achievement-A Systematic Review*. Front Psychol, 2021. **12**: p. 746289.
5. Gan, S.K.-E., S.W.-Y. Wong, and P.-D. Jiao, *Religiosity, Theism, Perceived Social Support, Resilience, and Well-Being of University Undergraduate Students in Singapore during the COVID-19 Pandemic*. International Journal of Environmental Research and Public Health, 2023. **20**(4): p. 3620.
6. Gan, S.K., C.Y. Loh, and B. Seet, *Hypertension in young adults—an under-estimated problem*. Singapore Med J, 2003. **44**(9): p. 448-52.
7. Yew, S.-H., et al., *The association between perceived stress, life satisfaction, optimism, and physical health in the Singapore Asian context*. Asian Journal of Humanities and Social Sciences (AJHSS), 2015. **3**(1): p. 56-66.
8. Kang, J.K., J.-H. Tay, and S.K.-E. Gan, *The Effect of Perceived Workplace Bureaucracies on Self-Evaluated Efficacy, Job Satisfaction and Motivation in the Workplace during the COVID-19 Pandemic*. 2022.
9. Ng, R.Y.-X., et al., *The associations between dietary practices and dietary quality, biological health indicators, perceived stress, religiosity, culture, and gender in multicultural Singapore*. Journal of Ethnic Foods, 2018. **5**(3): p. 220-227.
10. Miller-Grandvaux, Y., *USAID and Community Schools in Africa: The Vision, the Strategy, the Commitment*, in *Community Schools in Africa: Reaching the Unreached*, K. Helmore, et al., Editors. 2007, Springer US: Boston, MA. p. 133-153.
11. Lin, S. and Z. Li, *City profile: Wenzhou - A model city of transitional China*. Cities, 2019. **95**.
12. Connolly, N. and M.E. Abdalla, *Impact of COVID-19 on medical education in different income countries: a scoping review of the literature*. Med Educ Online, 2022. **27**(1): p. 2040192.
13. Walters, M., T. Alonge, and M. Zeller, *Impact of COVID-19 on Medical Education: Perspectives From Students*. Academic Medicine, 2022. **97**(3S): p. S40-S48.
14. Turana, Y., et al., *Impact on Medical Education and the Medical Student's Attitude, Practice, Mental Health, After One Year of the Covid-19 Pandemic in Indonesia*. Frontiers in Education, 2022. **7**.
15. Jiang, Q., H. Horta, and M. Yuen, *International medical students' perspectives on factors affecting their academic success in China: a qualitative study*. BMC Med Educ, 2022. **22**(1): p. 574.
16. Serwah, A., et al., *Assessment of the level of satisfaction of final years medical students with the clinical training at Taif teaching hospitals, KSA*. Journal of Contemporary Medical Education, 2015. **3**(2).
17. Panthi, S., et al., *Medical students' attitude towards cultural diversity: a cross-sectional study at a health sciences university in eastern Nepal*. BMJ Open, 2022. **12**(5): p. e057062.
18. Umakanthan, S., et al., *COVID-19 Awareness among Undergraduate Medical Students in Trinidad: A Cross-Sectional Study*. International Medical Education, 2022. **1**(2): p. 22-32.