

Perception and Mental Health Status Regarding COVID-19 Vaccination Among Taiwanese Adolescents and Their Caregivers

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Background: Vaccinating adolescents is a vital strategy to enhance population protection without imposing overly restrictive measures on our daily lives during the COVID-19 pandemic. As teenagers gain more independence, their willingness to get vaccinated may depend on their own understanding of the pandemic, vaccines, and mental well-being, as well as that of their caregivers. Our study aimed to examine how Taiwanese adolescents and their caregivers perceive COVID-19 vaccination and assess their mental health status.

Methods: We invited a total of 138 vaccinated adolescents and their caregivers to complete several questionnaires, including the Drivers of COVID-19 Vaccination Acceptance Scale (DrVac-COVID19S), Impact of Event Scale (IES), and Chinese Health Questionnaire (CHQ).

Results: Among the adolescents, 76.8% considered the BNT162b2 vaccine (Pfizer-BioNTech) as the ideal option for COVID-19 vaccination, while 27.5% of caregivers expressed acceptance of any available vaccine. Adolescents scored higher than caregivers in terms of vaccine value ($p < 0.001$) and autonomy ($p < 0.001$), but lower in knowledge ($p < 0.001$), as assessed by the DrVac-COVID19S subscales. The adolescents' intention to get vaccinated against COVID-19 (DrVac-COVID19S total score) showed a positive correlation with their perception of the pandemic's impact (IES scores, $r = 0.214$, $p = 0.012$) and their caregivers' vaccination intention ($r = 0.371$, $p < 0.001$). Furthermore, adolescents' mental health demonstrated a positive association with the mental health of their caregiver (CHQ total scores, $r = 0.481$, $p < 0.001$).

Conclusion: During the COVID-19 outbreak, caregivers have encountered heightened levels of mental stress, and this stress has been found to be positively correlated with the mental stress experienced by adolescents and their intentions regarding vaccination. These findings can serve as crucial references for healthcare providers and governments when formulating vaccination policies for adolescents in the future.

Keywords: adolescent, autonomy, caregivers, vaccine, psychosomatic, SARS-Cov-2

Introduction

In 2019, a novel respiratory infectious disease, identified as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), surfaced and swiftly propagated worldwide, leading to illness and death.¹ On March 11, 2020, the World Health Organization officially declared the outbreak of SARS-CoV-2 a global pandemic.² Governments worldwide implemented various measures

to reduce the spread of the virus, including border closures, city lockdowns, mandatory quarantines, and swiftly initiating training programs for healthcare professionals.^{3,4} Public health policies were put in place to mitigate the risk of infection and severe complications, such as practicing social distancing, wearing masks, and maintaining frequent hand hygiene.² These measures have significantly impacted our daily lives. Thankfully, vaccines against SARS-CoV-2 have been developed, approved, manufactured, and administered in numerous countries, offering us an active means of protection by bolstering our immune system against the virus.^{5–7}

However, the perception and hesitancy surrounding vaccines have emerged as significant concerns within the global biopsychosocial context. In the United States, a systematic review uncovered the most pronounced hesitancy levels within the Black/African American community and among pregnant or breastfeeding women.⁸ In India, an institution-specific survey unveiled certain specific anti-vaccine attitudes and beliefs.^{9,10} In Brazil, a survey highlighted caregivers' beliefs that children who had a natural infection do not require vaccination.¹¹ In France, vaccine hesitancy was found to be correlated with political party affiliation and active participation in the political system.¹²

Taiwan, an island nation with a population of 23 million, was not exempt from the SARS-CoV-2 outbreak. However, the Taiwanese government's guided strategies played a significant role in curtailing the disease's dissemination during the initial phases of the pandemic, providing valuable time for the development of vaccines.¹³ In September 2021, the Taiwan Centers for Disease Control authorized the vaccination of children and adolescents aged 12 to 17. Adolescents who congregate at schools face a higher risk of virus transmission, even though most of them experience asymptomatic or mild SARS-CoV-2 infections. Vaccinating adolescents can help prevent severe complications and the transmission of the virus to family members with underlying chronic illnesses, which could potentially lead to fatalities.² In order to maximize population protection without excessively encroaching on our daily lives, vaccination is recommended if there are no contraindications.¹⁴

Our previous research revealed that caregivers of adolescents exhibited less protective behavior towards SARS-CoV-2 and experienced lower emotional impact compared to caregivers of preschool-aged children.¹⁵ Adolescents have a better comprehension of the virus and vaccines compared to younger children. The development of autonomy in adolescents also influences their vaccination decisions, although current regulations in Taiwan still require parental consent. However, the novelty of the vaccines and concerns about potential adverse effects, such as myocarditis, fever, and chills, may cause caregivers to hesitate when it comes to vaccinating their children.¹⁶ Additionally, numerous studies have highlighted the influence of COVID-19 on the mental health of adolescents, including substance use disorders, insomnia, anxiety, depression, and post-traumatic stress disorder, which has increased the focus on providing adequate mental health care for both current and future needs of adolescents.^{17–20} The well-being, both physical and mental, of adolescents can also be affected by the mental health of their caregivers in various ways.^{21–23} However, the relationship between adolescents' attitudes towards COVID-19 vaccination and those of their caregivers remains unclear.

In order to achieve optimal vaccine coverage and develop future policies for adolescent vaccination, the goal of this study was to evaluate the perception and mental health status regarding COVID-19 vaccination among Taiwanese adolescents and their caregivers. The research also investigated the interrelationship between the perception and mental health status of adolescents, as well as that of their caregivers.

Methods

Study Design and Measures

Starting from September 2021, the Taiwanese government has granted authorization for the administration of COVID-19 vaccines for children and adolescents. This cross-sectional survey focuses on examining the experiences of adolescents who received the vaccine between March 31 and September 30, 2022, in Kaohsiung, Taiwan, along with their caregivers. Participants were requested to complete a questionnaire during the vaccine administration period, which spanned from June 30 to September 30, 2022. The questionnaire was anonymous and consisted of four sections: basic demographic information, the Drivers of COVID-19 Vaccination Acceptance Scale (DrVac-COVID19S), the Impact of Event Scale (IES), and the Chinese Health Questionnaire (CHQ). Participants were invited to complete the questionnaire either through a self-test on paper or through an online questionnaire.

Drivers of COVID-19 Vaccination Acceptance Scale (DrVac-COVID19S)

The Drivers of COVID-19 Vaccination Acceptance Scale is a questionnaire designed to evaluate individuals' willingness to accept COVID-19 vaccination.²⁴ The questionnaire comprises 12 items that participants are required to rate on a 7-point Likert scale, which ranges from 1 (strongly disagree) to 7 (strongly agree). The scale is divided into four domains: values (eg, "It is crucial that I get the COVID-19 shot"), impact (eg, "Vaccination is highly effective in protecting me from COVID-19"), knowledge (eg, "I am well-informed about how vaccination protects me from COVID-19"), and autonomy (eg, "I can choose whether to get the COVID-19 shot"), with each domain consisting of three items. The scores for each domain are summed up, and higher scores indicate a greater willingness to receive the COVID-19 vaccine. Prior studies have provided backing for the utilization of a four-factor structural model for the DrVac-COVID19S, which employs four CME constructs.²⁴ Additionally, the DrVac-COVID19S has demonstrated satisfactory known-group validity, and its measurement invariance has been established.^{25–27}

Impact of Event Scale (IES)

The Impact of Event Scale, a self-report assessment tool, has seen extensive use across various demographic groups and for various types of traumas. Its purpose is to evaluate the impact of specific stressful life events.²⁸ The scale comprises 15 items that are rated on a four-point frequency scale (0 = not at all, 1 = rarely, 3 = sometimes, 5 = often) based on the individual's experiences over the preceding week. A greater score signifies a more frequent occurrence of intrusive thoughts and avoidance behaviors. The Chinese translation of the IES showed satisfactory validity in a study involving oral cancer patients.²⁹ Furthermore, it has been employed to assess adolescent earthquake victims in Taiwan.³⁰

Chinese Health Questionnaire (CHQ)

The Chinese Health Questionnaire is a self-administered screening tool specifically designed to evaluate psychiatric morbidity within the ethnic Chinese community.³¹ It is a culturally sensitive instrument that was developed based on the General Health Questionnaire³² and has demonstrated satisfactory construct validity. The CHQ has been utilized in various settings, including hospitals³³ and community settings,³⁰ to evaluate psychiatric morbidity. The questionnaire consists of four factors: somatic symptoms, anxiety and worrying, sleep problems, and depression and poor family relationships.³⁴ In our study, we employed the 12-item version of the CHQ, known as the CHQ-12.

Statistical Analysis

We performed data analysis using SPSS version 21.0, a statistical software package developed by SPSS Inc. in Chicago, IL, USA. Additionally, we performed path analysis utilizing structural equation modeling (SEM) with the assistance of Analysis of Moment Structures (AMOS) version 24.0. Statistical significance was determined at p-values < 0.05 using two-tailed tests. The study initially employed paired t-tests to compare the scores of COVID-19 vaccination acceptance, IES, and CHQ between adolescents and their caregivers. Pearson's correlation was then utilized to examine the interrelationships among the Vaccination Acceptance Scale, IES, and CHQ scores of both adolescents and their caregivers.

Results

This study included a total of 138 teenagers who had received the COVID-19 vaccine. Among them, there were 75 females, and the mean age was 13.9 years (Table 1). In terms of school grade, 7.2% of the teenagers were in elementary school (grade 6), 52.9% were in junior high school (grades 7 to 9), and 39.9% were in senior high school (grades 10 to 12). The teenagers had received different doses of the COVID vaccine, with 15.2% receiving one dose, 19.6% receiving two doses, and 65.2% receiving three doses. Regarding the decision-maker for the vaccinations, 8.7% were fathers, 47.1% were mothers, 38.4% were both parents, and 5.8% were other relatives. For the ideal option of the COVID vaccine, 76.8% of the teenagers chose Pfizer-BioNTech, 12.3% chose Moderna (mRNA-1273), 1.4% chose Oxford-AstraZeneca COVID-19 vaccine (AZ), 5.1% chose Medigen Vaccine Biologics Corporation-COV1901 (MVC), and 4.4% indicated that any vaccine would be fine.

Table 1 Characteristics of Adolescents Who Received COVID-19 Vaccination

	Adolescents (n=138)	
	N or Mean	% or SD
Sex (male)		
Males	63	45.7
Females	75	54.3
Age (years, mean \pm SD)	13.9	1.9
Education		
Elementary school (6th grade)	10	7.2
Junior high school (7th –9th grade)	73	52.9
Senior high school (10th –12th grade)	55	39.9
Who made the decision of your vaccination		
Father	12	8.7
Mother	65	47.1
Both parents	53	38.4
Other relatives	8	5.8
How many shots of COVID vaccine		
1	21	15.2
2	27	19.6
3	90	65.2
Ideal option of COVID vaccine		
BNT	106	76.8
Moderna	17	12.3
AZ	2	1.4
MVC	7	5.1
Any will be fine	6	4.4

Abbreviations: AZ, Oxford–AstraZeneca COVID-19 vaccine; BNT, BNT162b2 (Pfizer–BioNTech); Moderna, mRNA-1273; MVC, Medigen Vaccine Biologics Corporation (MVC)-COV1901.

Table 2 presents the characteristics of the 138 caregivers of teenagers who received the COVID-19 vaccine. Among the caregivers, there were 115 females, and the mean age was 45.8 years. In terms of educational level, 79% of the caregivers had completed college or obtained higher levels of education. Regarding marital status, 87% of the caregivers were married and cohabitating. The caregivers had received different doses of the COVID vaccine, with 10.1% receiving two doses, 64.5% receiving three doses, and 23.9% receiving four doses. For the caregivers' ideal option of COVID vaccine, 36.2% of the caregivers chose Pfizer-BioNTech, 27.5% chose Moderna, 2.9% chose AZ, 5.8% chose MVC, and 27.5% indicated that any vaccine would be fine.

Table 3 demonstrates the findings regarding the intention of COVID-19 vaccination (DrVac-COVID19S), the influence of the COVID-19 pandemic (IES), and mental health (CHQ) among adolescents and their caregivers. In terms of the DrVac-COVID19S subscales, caregivers had higher knowledge scores ($p<0.001$), but lower values scores ($p<0.001$) and lower autonomy ($p<0.001$) compared to adolescents. However, there were no significant differences in IES scores between adolescents and caregivers. The caregivers exhibited greater distress in all domains of CHQ, including somatic symptoms ($p=0.003$), anxiety and worrying ($p<0.001$), depression ($p=0.004$), and sleep problems ($p<0.001$).

Table 4 presents the correlations between the intention of COVID-19 vaccination, the influence of the COVID-19 pandemic, and mental health among teenagers and their caregivers. The study found that adolescents' intention to get vaccinated against COVID-19 (DrVac-COVID19S total score) was positively correlated with their IES scores ($r=0.214$, $p=0.012$) and their caregivers' intention to get vaccinated ($r=0.371$, $p<0.001$). Furthermore, adolescents' IES scores were positively correlated with their CHQ total scores ($r=0.349$, $p<0.001$). Adolescents' CHQ scores were positively

Table 2 Characteristics of the Caregivers of Adolescents Who Received COVID-19 Vaccination

	Caregivers (n=138)	
	N or Mean	% or SD
Sex		
Males	23	16.7
Females	115	83.3
Age (years, mean \pm SD)	45.8	4.6
Education		
Senior high school or lower	29	21.0
College or above	109	79.0
Marriage status		
Married and cohabitation	120	87.0
Separated or divorced	18	13.0
Numbers of children		
1	18	13.0
2	89	64.5
≥ 3	31	22.5
How many shots of COVID vaccine		
2	14	10.1
3	89	64.5
4	33	23.9
Ideal option of COVID vaccine for child		
BNT	50	36.2
Moderna	38	27.5
AZ	4	2.9
MVC	8	5.8
Any will be fine	38	27.5

Abbreviations: AZ, Oxford–AstraZeneca COVID-19 vaccine; BNT, BNT162b2 (Pfizer–BioNTech); Moderna, mRNA-1273; MVC, Medigen Vaccine Biologics Corporation (MVC)-COV1901.

Table 3 Intention of COVID-19 Vaccination, Influence of COVID-19 Pandemic and Mental Health Among the Teenagers and Their Caregivers

	Adolescents (n=138)	Caregivers (n=138)	Paired t-test	p-value
DrVac-COVID19S				
Impact	6.8 \pm 2.7	6.4 \pm 3.3	-1.297	0.197
Knowledge	5.0 \pm 2.2	6.9 \pm 2.6	6.399	<0.001
Value	7.9 \pm 2.3	6.2 \pm 3.2	-5.385	<0.001
Autonomy	8.9 \pm 3.5	7.5 \pm 2.8	-4.722	<0.001
Total score	28.5 \pm 6.6	27.0 \pm 9.6	1.889	0.061
Impact of Event Scale (IES)				
Intrusion	11.4 \pm 4.7	12.5 \pm 5.5	1.899	0.060
Avoidance	13.3 \pm 5.4	14.1 \pm 5.9	1.327	0.187
Total score	24.7 \pm 9.9	26.7 \pm 11.1	1.648	0.102
Chinese Health Questionnaire (CHQ)				
Somatic symptoms	5.6 \pm 2.2	6.3 \pm 2.3	3.025	0.003
Anxiety and worrying	4.6 \pm 1.9	5.7 \pm 2.1	5.977	<0.001
Depression	6.7 \pm 2.0	7.2 \pm 1.8	2.947	0.004
Sleep	1.5 \pm 0.8	1.9 \pm 0.8	3.951	<0.001
Total score	18.4 \pm 5.9	21.0 \pm 6.1	-5.015	<0.001

Abbreviation: DrVac-COVID19S, The Drivers of COVID-19 Vaccination Acceptance Scale.

Table 4 Correlations Between Intention of COVID-19 Vaccination, Influence of COVID-19 Pandemic and Mental Health Among the Teenagers and Their Caregivers

	Adolescents (n=138)			Caregivers (n=138)		
	Vaccination	IES	CHQ	Vaccination	IES	CHQ
Adolescents (n=138)						
Vaccination	–					
IES total scores	0.214*	–				
CHQ total scores	0.062	0.349**	–			
Caregivers (n=138)						
Vaccination	0.371**	–0.092	0.084	–	–	
IES total scores	0.002	0.095	0.230**	–0.089	–	
CHQ total scores	–0.088	0.107	0.481**	–0.062	0.297**	–

Notes: Data were shown as Pearson's correlation coefficient. * $p < 0.05$, ** $p < 0.01$.

Abbreviations: IES, Impact of Event Scale; CHQ, Chinese Health Questionnaire.

correlated with their caregivers' IES scores ($r=0.230$, $p=0.007$) and CHQ total scores ($r=0.481$, $p<0.001$). Lastly, caregivers' IES scores were positively correlated with their CHQ total scores ($r=0.297$, $p<0.001$).

Discussion

In light of the increased risk of virus transmission among adolescents gathering at school, it is important to address the need for vaccination to mitigate the spread of the virus to their homes. While the omicron variant has shown that two doses of COVID-19 vaccine offer limited effectiveness in preventing symptomatic disease, booster shots are still recommended to ensure ongoing protection and to sustain normal daily activities during the pandemic.^{35,36} In Taiwan, the government-funded COVID-19 vaccines were available to adolescents at school with parental consent. In our study conducted in Kaohsiung, Taiwan, our objective was to investigate the mental health status and vaccination intentions of these adolescents and their caregivers.

A total of 138 adolescents and their caregivers participated in our study and completed the questionnaires. Throughout the study period, the COVID-19 vaccines available in Taiwan included Pfizer–BioNTech, Moderna, AZ, and MVC. The BNT vaccine was approved for use as a two-dose primary series and a single booster dose for adolescents aged 12–17 in Taiwan. The Moderna vaccine was administered as a two-dose primary series. The AZ vaccine was among the first vaccines available in Taiwan, although it was not approved for use in adolescents. The MVC vaccine, a protein subunit COVID-19 vaccine, had completed Phase 2 trials for adolescents but had not yet received approval for emergency use authorization from the Taiwanese government.^{37,38} In our study, 65.2% of the adolescents had been administered three vaccine doses. Additionally, 76.8% of the adolescents considered the BNT vaccine to be the ideal option for the COVID-19 vaccine. This preference may be attributed to the unified vaccination program in schools, peer influence, and the higher risk of severe complications such as myocarditis associated with Moderna in young men after the second dose.³⁹

In our study, the caregivers who filled out the questionnaire were predominantly female, accounting for 83.3% of the participants. Furthermore, 79% of the caregivers held a college education or higher, and 87% were married. A significant portion of the caregivers (77.5%) had more than two children. The decision-makers for COVID-19 vaccination were primarily mothers (47.1%) and both parents (38.4%). It is important to note that parents made their decisions in mind with their child's best interests, carefully evaluating the potential hazards of vaccinating their children in comparison to the risks posed by contracting preventable diseases through vaccination.⁴⁰ Prior studies have indicated that women are less likely than men to have the intention to be vaccinated. In the case of mothers as the primary caregivers for adolescents, this may be associated with a lower intention to vaccinate their adolescents.⁴¹ However, it is worth mentioning that although 63.7% of caregivers preferred the mRNA vaccine for their adolescents, interestingly, 27.5% of caregivers believed that any vaccine would be fine. This may be attributed to various factors, such as both adolescents and caregivers having already received two or more doses of the vaccine and studies indicating that serious complications, such as myocarditis and pericarditis, are mostly self-limited.³⁹ Given that the vaccines available for adolescents varied at different stages of the pandemic in Taiwan, the government

encouraged individuals to get vaccinated with any available vaccine that was deemed safe and effective.⁴² Previous studies have suggested strategies to improve public perceptions of vaccines, including providing comprehensive details regarding the advantages and potential drawbacks of vaccines, specifically targeting adolescents and utilizing multiple communication channels, such as social media, to effectively deliver this information.⁴⁰ These strategies have been implemented in Taiwan.

Caregivers exhibited a higher level of vaccine knowledge compared to adolescents, as indicated by the results of the DrVac-COVID19S survey. However, caregivers scored lower in terms of valuing and autonomy regarding vaccines. On the other hand, adolescents displayed a significant level of autonomy in their decision-making about vaccinations, despite having less knowledge about vaccines. A study has highlighted that medical decision-making requires four essential capacities: communication of choice, understanding, reasoning, and appreciation. Given the ongoing development of the adolescent brain, they still require support in considering environmental factors to make decisions.⁴³ Educational institutions, such as schools, can play a vital role in enhancing disease and vaccine education. Furthermore, caregivers scored significantly higher in all domains of the CHQ compared to adolescents. Caregivers experienced various stressors related to the pandemic, including fear and anxiety, increased responsibility for their family members' well-being, social isolation, employment and financial challenges, limited access to medication, and marital strain.⁴⁴

Our findings indicate that there is a positive relationship between adolescent vaccination intention and both their own IES scores and their caregiver's vaccination intention. Moreover, we found a positive association between adolescent IES scores and CHQ total scores. Additionally, adolescent CHQ scores were positively correlated with caregiver IES scores and CHQ scores. Previous research has highlighted that children often feel responsible for their caregiver's stress amid the COVID-19 pandemic, underscoring the importance of caregivers acknowledging and addressing these concerns using age-appropriate language.⁴⁵ Given the critical nature of mental health during and after the pandemic, it is crucial for governments to provide ongoing support and resources for adolescents and their caregivers, particularly those experiencing higher levels of stress. This approach will contribute to a successful vaccination campaign and help alleviate the lasting effects of the pandemic.

Our study makes a significant contribution to the field as the first to simultaneously investigate the perception and mental health status regarding COVID-19 vaccination in Taiwanese adolescents and their caregivers. We also thoroughly examined the inter-relationship between perception and mental health status among these groups. However, we recognize a number of limitations in our study. Firstly, the number of questionnaires collected was relatively small, and the sample collected in Kaohsiung may not be fully representative of Taiwan. Secondly, our study is cross-sectional, and the varying severity of the pandemic during the study period may have influenced the mental health status of family members.⁴⁶ Thirdly, parental consent for adolescent vaccination may introduce selection bias. Lastly, we did not differentiate between respondents who were infected with COVID-19 and those who were not, and long COVID may contribute to poor physical and mental health outcomes including compromised sleep, depression, anxiety, and post-traumatic stress disorder.^{47–49} Therefore, further research is needed to longitudinally follow up on the mental and physical well-being of adolescents and their caregivers.

Conclusions

Our study utilized a questionnaire to investigate the perceptions and mental health status regarding COVID-19 vaccination among Taiwanese adolescents and their caregivers. Our goal was to promote widespread vaccination coverage both currently and in the future. Interestingly, adolescents demonstrated higher scores in vaccine value and autonomy compared to their caregivers in the DrVac-COVID19S subscales, but had lower knowledge. To enhance public health education on diseases and vaccines, particularly targeting adolescents, governments could focus on delivering information through schools and social media platforms. Caregivers experienced elevated levels of psychological stress during the COVID-19 pandemic, which was positively associated with the mental stress and vaccination intentions of adolescents. Providing caregivers with health handbooks prior to vaccination, containing information on disease introduction, vaccine benefits and risks, potential physical and mental health issues, and effective communication strategies with adolescents, can contribute to improved mental health during the pandemic. This, in turn, can increase vaccination intentions and help lessen the adverse effects of the pandemic in the future.

Data Sharing Statement

The data will be available upon reasonable request to the corresponding authors.

Ethics Statement

Ethical approval was obtained from the human research ethics committee of Chang Gung Memorial Hospital (CGMH) (202200200B0). Since participation was voluntary and survey responses were anonymous, the Institutional Review Board (IRB) of CGMH ruled that this study did not require informed consent. We confirmed this study complied with the Declaration of Helsinki.

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Disclosure

The authors report no conflicts of interest in this work.

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