



The relationship of intent to be COVID-19 vaccinated with depression, anxiety, insomnia, pain and smoking among Chinese patients with a pacemaker

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ABSTRACT

Background: This study examined the intent to be COVID-19 vaccinated and its correlates among patients with a pacemaker.

Methods: This observational study was carried out between July 1, 2021, and May 17, 2022 in Beijing, China. Patients with a pacemaker were consecutively invited by a research physician to participate in the study. Intent to be COVID-19 vaccinated, depression, anxiety, insomnia, pain and smoking were measured with standard scales or questions.

Results: Of the 206 participating patients, 72.82% (N = 150; 95% confidence interval [CI]: 66.74%–78.89%) expressed an intention to be COVID-19 vaccinated. Intent to be COVID-19 vaccinated was not significantly associated with severity of depression, anxiety, and insomnia. Multiple logistic regression analysis revealed that patients believing that COVID-19 vaccines provided protection and smokers were more likely to express an intention to receive COVID-19 vaccines. In contrast, older patients and those with higher level of physical pain were less likely to express an intention to be vaccinated against COVID-19.

Conclusions: Specific vaccination promotion strategies should be implemented targeting this vulnerable segment of the population.

1. Introduction

The COVID-19 pandemic has significantly contributed to the overall disease burden and severely disrupted social and economic developments worldwide. To date, there has been no specific treatment for COVID-19, only traditional public health measures, such as isolation and face masks, could be adopted. COVID-19 vaccines were developed to quickly achieve herd immunity and to effectively control the pandemic and reduce its negative outcomes. COVID-19 vaccines are new products that were developed within a short period of time. Thus, the public's knowledge on COVID-19-vaccines is limited, and there have been

concerns about their long-term adverse effects (Bai et al., 2021; Cai et al., 2021). This has resulted in vaccination hesitancy weakening herd immunity and increasing the risk and severity of COVID-19 infections, particularly in vulnerable populations, such as the elderly and patients with non-communicable chronic diseases (Shahid et al., 2020). COVID-19 vaccine hesitancy was found among patients with severe medical conditions (e.g., heart diseases), particularly older patients (Shahid et al., 2020), although they have higher risk of mortality and morbidity related to COVID-19 than the general population.

Due to the shortage of health professionals with interest in, and expertise of cardiac pacing, spreading information about pacing is

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limited relative to other heart diseases, such as myocardial infarction and heart failure. There are not enough health professionals who could follow up patients with a pacemaker in many areas of China, thus patients have to travel to big cities where their pacemaker were implanted to receive regular check-ups. During the COVID-19 pandemic, follow-up assessments became difficult due to the restriction of public transportation in many areas of China.

Heightened levels of anxiety, depression and insomnia could affect perception toward COVID-19 vaccination and excessive worry could result in vaccination hesitancy (Hao et al., 2021). Additionally, factors other than mental health including male gender, married marital status, perception of having high infection risk, vaccinated against influenza in the past season, and trusting the efficacy of COVID-19 vaccination could increase the probability of accepting COVID-19 vaccines (Wang et al., 2020; Reiter et al., 2020). To increase vaccination acceptance, it is important to understand the attitude of vulnerable populations toward COVID-19 vaccination. To this end, this study examined the intent to be vaccinated against COVID-19 and its correlates with depression, anxiety, insomnia, pain, fatigue and smoking among patients with a pacemaker. Based on previous findings (Cai et al., 2022; Bai et al., 2021), the main hypothesis was that the intent to be vaccinated against COVID-19 would be common among patients with a pacemaker.

2. Method

This study was carried out at the National Clinical Research Center for Cardiovascular Diseases, Beijing, China between July 1, 2021, and May 17, 2022. Similar to other studies (Cai et al., 2022; Bai et al., 2021), to avoid contagion during the COVID-19 pandemic, the use of interviewer-rated instruments and sophisticated study design (e.g., multi-stage, random sampling and inclusion of healthy controls and those with physical diseases without pacemaker) could not be adopted. Patients with a pacemaker who were regularly followed up for maintenance treatment during the study period were consecutively invited by a research physician to participate in the study. This study was conducted following the Declaration of Helsinki. The study protocol was approved by the Clinical Research Ethics Committee of Beijing Anzhen Hospital (2021098X).

Patients' sociodemographic data (age, gender, education level, marital status, health insurance, perceived economic and health status, smoking and drinking) were recorded. Based on previous assessments on attitudes toward COVID-19 vaccines (Bai et al., 2021; Cai et al., 2021), a single question on attitude toward COVID-19 vaccines was: "Do you intend to be vaccinated against COVID-19 in the future?" (No/Yes). The severity of depressive symptoms was measured using the validated Chinese version of the 9-item Patient Health Questionnaire; each item was scored between "0" (not at all) and "3" (nearly every day). The severity of anxiety was assessed using the locally validated General Anxiety Disorder-7 questionnaire that includes 7 items; each was scored between 0 (not at all) and 3 (nearly every day). The severity of insomnia was assessed with the validated Chinese version of the self-reported Insomnia Severity Index (ISI) scale. The ISI consists of seven items with each scored from "0 (none)" to "4 (very severe)". Those with an ISI total score of ≥ 8 were classified as having insomnia. Fatigue was measured using a one-item numerical Fatigue Rating Scale; scores ranged between 0 (no fatigue) and 10 (extreme fatigue). The severity of pain was assessed with the one-item Numerical Pain Rating Scale, which has satisfactory psychometric properties in Chinese populations; scores ranged from '0' (no pain at all) to '10' (worst pain imaginable). Global quality of life was assessed using the first two items of the validated Chinese version of World Health Organization Quality of Life Scale Brief Version.

P-P plots were used to check normal distribution for continuous variables. The chi-square test, independent-samples Student's *t*-test, and Mann-Whitney *U* test were used to compare variables between patients with and without intent to be COVID-19 vaccinated. Multiple logistic

regression analyses were carried out to explore the independent variables affecting the intent to be COVID-19 vaccinated. A two-tailed *p* value of < 0.05 was considered statistically significant.

3. Results

The mean age of the participating 206 patients was 68.65 (SD: 12.48) years; 106 (51.5%) were male (Table 1). Around two thirds of participants (86.9%; 95%CI: 82.88–91.50%) encouraged their family and friends to get vaccinated with COVID-19 vaccines, 49.5% (95%CI: 42.69–56.34%) thought that COVID-19 vaccines were safe, and 72.82% (95% confidence interval [CI]: 66.74%–78.89%) expressed their intention to receive the COVID-19 vaccines. Univariate analyses showed that their intent to be COVID-19 vaccinated was not significantly associated with the severity of depressive and anxiety symptoms and insomnia. Multiple logistical regression analysis found that patients believing that COVID-19 vaccines provide protection (odds ratio [OR]:3.051; 95% CI: 1.387–6.710; $p = 0.006$) and smokers (OR: 3.303; 95% CI: 1.237–8.823; $p = 0.017$) were more likely to express an intention to be vaccinated against COVID-19 than their non-believing and non-smoking counterparts. Older patients (OR: 0.967; 95% CI: 0.937–0.998; $p = 0.039$) or those reporting higher level of physical pain (OR: 0.781; 95% CI: 0.625–0.976; $p = 0.030$) were less likely to express an intention to be COVID-19 vaccinated (Table 1).

4. Discussion

The intent to be COVID-19 vaccinated was common in patients with a pacemaker, which is consistent with the results observed in other vulnerable populations, e.g., in severe psychiatric disorders (Cai et al., 2022; Bai et al., 2021). Several reasons may have contributed to the high intent to be COVID-19 vaccination found in this study. First, most patients with a pacemaker were older adults who may have no, or inadequate access to accurate information about COVID-19 vaccines partly due to their impaired cognitive function or social isolation. Second, myocarditis has been recognized as a potential side effect of COVID-19. The US Centers for Disease Control and Prevention reported that myocarditis/pericarditis rate was 12.6 cases per million doses of the second-dose mRNA vaccine (Luk et al., 2021). Public concern regarding vaccine safety has been frequently reported as a major obstacle to the rollout of vaccines, especially new ones" to "vaccines (Lau et al., 2010; Nguyen et al., 2011; Yaqub et al., 2014; Schwarzinger et al., 2010). Development of most new vaccines usually needs an average of 10 years, but many COVID-19 vaccines were only tested with much shorter assessments (WHO, 2022), which increased concerns about their safety.

As expected, patients with a pacemaker who thought that COVID-19 vaccines provide protection reported higher intent to be COVID-19 vaccinated. Patients who smoked were also more likely to express an intention to be COVID-19 vaccinated than their non-smoking counterparts, which did not support the findings reported for adults in the UK (Jackson et al., 2021) and the general population in mainland China (Wu et al., 2022) and Hong Kong (Luk et al., 2021). Smoking increases the severity and mortality risks due to COVID-19 (WHO, 2020). Smoking increased during the COVID-19 pandemic. Smokers may be more likely to accept COVID-19 vaccines to reduce the risks of the negative outcomes.

With the widespread use of the newly approved COVID-19 vaccines to build herd immunity, vaccine acceptance by vulnerable populations, such as older adults or medically compromised people, has attracted attention. In this study, older participants with a pacemaker reported less intent to be COVID-19 vaccinated than their younger counterparts. Older people have poor general health status and they are more likely to suffer from chronic medical and psychiatric comorbidities, thus many elderly were understandably concerned about the potentially severe side effects of COVID-19 vaccines, such as myocarditis (Witberg et al., 2021), and less severe, yet troublesome ones, such as fatigue, lethargy,

Table 1

Characteristics and analysis of participants with and without intent to be vaccinated against COVID-19 (N = 206, data were collected between July 1, 2021, and May 17, 2022 in Beijing, China).

Variables	Intent to be vaccinated against COVID-19				Univariate and Multiple logistic regression analysis		
	Total (N = 206) N%	No (N = 56) N%	Yes (N = 150) N%	P ^a	OR	95% CI	p
Male gender	106 (51.5)	25 (44.6)	81 (54)	0.273	–	–	–
Female gender	100 (48.5)	31 (55.4)	69 (46)	0.273	–	–	–
College education or higher	65 (31.6)	15 (26.8)	50 (33.3)	0.404	–	–	–
Married	162 (78.6)	39 (69.6)	123 (82.0)	0.059	–	–	–
Covered by insurance	204 (99.0)	56 (100)	148 (98.7)	1.000	–	–	–
Good perceived economic status	23 (11.2)	7 (12.5)	16 (10.7)	0.804	–	–	–
Good perceived health status	45 (21.8)	11 (19.6)	34 (22.7)	0.708	–	–	–
Smoker	49 (23.8)	7 (12.5)	42 (28.0)	0.026	3.303	1.237–8.823	0.017
Social drinker	45 (21.8)	9 (16.1)	36 (24.0)	0.259	–	–	–
Worried about being infected with COVID-19	68 (33.0)	22 (39.3)	46 (30.7)	0.249	–	–	–
Heard about COVID-19 vaccines	175 (85.0)	39 (69.6)	136 (90.7)	< 0.001	1.536	0.561–4.195	0.404
Believed COVID-19 vaccines provide protection	124 (60.2)	20 (35.7)	104 (69.3)	< 0.001	3.051	1.387–6.710	0.006
Encouraged by family and friends to get vaccinated	179 (86.9)	39 (69.6)	140 (93.3)	< 0.001	2.791	0.965–8.701	0.058
Believed vaccines are safe	102 (49.5)	19 (33.9)	83 (55.3)	0.008	1.420	0.651–3.097	0.379
	Mean (SD)	Mean (SD)	Mean (SD)	P ^b			
Age	68.65 (12.48)	71.46 (13.38)	67.61 (12.00)	0.049	0.967	0.937–0.998	0.039
Global QOL	6.62 (1.45)	6.45 (1.59)	6.68 (1.39)	0.336	–	–	–
	Median	Median	Median	P ^c			
PHQ-9 total score	6.50	3.50	2.50	0.190	–	–	–
GAD-7 total score	3.00	0.50	1.00	0.062	–	–	–
ISI total score	1.00	7.00	6.00	0.196	–	–	–
Physical pain total score	2.00	3.00	1.00	0.001	0.781	0.625–0.976	0.030
Physical fatigue total score	2.00	3.50	2.00	0.028	1.076	0.858–1.350	0.526

Abbreviations: N = number of participants; OR = odds ratio; CI = confidence interval; SD = standard deviation; df = degree of freedom; COVID-19 = coronavirus disease 2019; PHQ-9 = 9-item Patient Health Questionnaire; GAD-7 = Generalized Anxiety Disorder scale; ISI = Insomnia Severity Index; QOL = Quality of Life ; .

^a Mann–Whitney *U* test; ^a:P-values based on Chi-squared statistics, ^b: P-values based on Z-Score and ^c: P-values based on Mann Whitney *U* test.

headache, and tenderness of the injection site (Saeed et al., 2021), because these may increase the risks of hospitalization, admission to intensive care and mortality.

Pain is one of the most commonly reported symptoms among patients with a pacemaker. Patients with a higher level of pain were less likely to report intent to be COVID-19 vaccinated. This may be partly attributable to concerns regarding the above-mentioned severe side effects of COVID-19 vaccines, particularly myocarditis (Witberg et al., 2021) and fatigue. To increase COVID-19 vaccine acceptance, it is important to address pain control for patients with a pacemaker. Due to reduced physical and social activities in the community, patients with a pacemaker may have limited access to information about COVID-19 vaccines. Supportive measures, such as establishment of patient support groups and even more vigorous public education about COVID-19, may facilitate the exchange of information and ideas, coping options, and alternative perspectives about COVID-19 vaccines (Cai et al., 2022).

There are notable limitations to the study. First, the casual associations between attitudes toward COVID-19 vaccines and other variables could not be examined because of the cross-sectional study design. Second, the relatively small sample size and convenience rather than random sampling method are likely to limit the generalizability of the findings. Third, the use of self-report measures may have resulted in recall bias. Fourth, intent to be COVID-19 vaccinated dynamically changed due to the COVID-19 vaccination campaign, which could not be examined. Fifth, for logistical reasons, control groups, including elderly without physical diseases and those with physical diseases other than requiring a pacemaker, were difficult to recruit in this study during the pandemic.

In conclusion, intent to be COVID-19 vaccinated was common among patients with a pacemaker, particularly who were a smoker and who thought that COVID-19 vaccines provide protection. More robust vaccination promotion strategies should be implemented targeting this vulnerable population.

5. Financial disclosure

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6. Ethics statements

This study was conducted following the Declaration of Helsinki. The study protocol was approved by the Clinical Research Ethics Committee of Beijing Anzhen Hospital (2021098X).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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