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Awareness of Influenza and Attitude Toward Influenza Vaccination Among Clinical and Non-clinical medical student:a cross-sectional study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-055945
Article Type:	Original research
Date Submitted by the Author:	02-Aug-2021
Complete List of Authors:	Wang, Yunlong; Chongqing Medical University Zou, Fa; Chongqing Medical University Gan, Lin; Chongqing Medical University Luo, Qinwen; Chongqing Medical University Tang, Xiaojun; Chongqing Medical University
Keywords:	Epidemiology < INFECTIOUS DISEASES, Public health < INFECTIOUS DISEASES, IMMUNOLOGY

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4 **Awareness of Influenza and Attitude Toward Influenza**
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7 **Vaccination Among Clinical and Non-clinical medical**
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9 **student : a cross-sectional study**
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ABSTRACT

Objective This study aimed to understand the knowledge, attitudes, and practices (KAP) on influenza Vaccination between Clinical and Non-clinical medical students.

Methods A stratified cluster sampling method was used to survey the students of a medical school in Chongqing.

Results Clinical students had a higher rate of knowledge about influenza and influenza vaccine than non-clinical students (66.64%>58.03%), a lower rate of influenza vaccination than non-clinical students (5.17%<10.71%), and a similar rate of willingness to receive influenza vaccination (33.6%,33.7%). The results of the multifactorial analysis showed that for non-clinical students, medical students who knew about the vaccine (OR=2.23, 95% CI:1.28-3.98) and those who were actively informed about the vaccine were more likely to receive the influenza vaccine (OR=2.08, 95% CI:1.20-3.16); for clinical students, female medical students (OR=1.55, 95% CI:1.03-2.33) versus non-smoking medical students (OR=2.39, 95% CI:1.22-4.74) were more likely to get the influenza vaccine. Medical students with positive attitudes (OR=4.17, 95% CI:1.75-12.34) were more likely to get the influenza vaccine than medical students with negative attitudes toward the influenza vaccine.

Conclusion The influenza vaccination rate of clinical and non-clinical medical school students in Chongqing is low, and smoking and male clinical students are more reluctant to get a flu vaccine. A combination of old and new media should take different promotional measures for different groups in different professions.

Key words

Education,Flu,Immunization,Vaccine,Infection

Highlight

- Clinical students more willing to get flu vaccine than non-clinical students
- smoking and male clinical students more reluctant to get a flu vaccine
- Clinical students' reluctance to receive the new vaccine may be due to overwhelming concerns about the vaccine's safety

Strengths and limitations of this study

- This is the first representative study in Southwest China to assess the willingness of clinical and non-clinical students to receive influenza vaccine and the factors influencing influenza vaccination.
- Correctly develop statistical survey programs, design questionnaires, and minimize statistical survey bias
- the COVID-19 pandemic has spread enormous information about viruses in general, medical students would have had more opportunities to study infectious diseases than before.So our existing conclusions may have changed a little.

Background

Influenza (flu for short), a respiratory infection, is highly contagious and can easily cause epidemics in the population. According to the World Health Organization (WHO) data, the annual incidence of influenza is estimated at 5-10% of adults and

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4 20-30% of children, causing 3-5 million severe cases and 250,000-500,000 deaths
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6 worldwide each year [1]. So influenza vaccination is the essential tool to prevent
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8 influenza infection and is a public health priority worldwide, with formal
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10 recommendations for vaccination of health care workers established in almost all
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12 countries [2-3]. Among them, China's Influenza Treatment Program (2020 version)
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14 clearly states that "annual influenza vaccination is the most effective means of
15
16 influenza prevention, reducing the risk of influenza and serious complications in
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18 vaccinated individuals" [4-5].
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25 As a place where students gather, the relatively crowded learning and living
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27 environment of schools are prone to influenza, and college students are highly mobile
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29 between campuses. Surveillance data from several provinces in recent years have
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31 shown that more than 90% of influenza occurring each year occurs on campus [5-6].
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33 Medical students, however, are at higher risk of influenza illness than other college
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35 students due to the specificity of their discipline. They are the future medical workers
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37 and important disseminators of health knowledge, and there is an excellent need for
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39 vaccination [7]. They are likely to live and work with susceptible populations or
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41 provide health education to susceptible populations in the future. Therefore it is
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43 crucial to assess vaccination coverage, knowledge attitudes, and beliefs of this
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45 specific population. Medical students are the future workers of health, and their
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47 behavior will influence the health of their patients. At the same time, in most medical
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49 schools, the medical student population can be divided into clinical and non-clinical.
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51 Clinical medicine refers to majors that offer systematic clinical medicine course,
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4 while non-clinical includes majors such as public health management, medical
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6 imaging, and pharmacy[6]. Both of them have different curricula design directions,
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8 resulting in differences in their knowledge of the influenza vaccine and a willingness
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10 to receive it.
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14 Little has been reported on the current status of influenza vaccination in this
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16 group in China. From the few studies, it was found that the current vaccination rate of
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18 medical students in China is much lower than that of foreign countries. [7-10]. There
19
20 are no studies comparing clinical and non-clinical students on their willingness to
21
22 receive influenza vaccination and analysis of factors influencing vaccination. So this
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24 study was conducted to investigate the main factors influencing medical students'
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26 willingness to receive influenza vaccination by investigating the knowledge and
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28 beliefs about influenza vaccine among clinical and non-clinical medical students so as
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30 to provide a scientific basis for improving the influenza vaccination rate of medical
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32 students and strengthening influenza prevention and control.
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43 **MATERIAL AND METHODS**

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48 *Study design and settings*

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51 From May 2019 to June 2019, according to the principle of stratified clus sampling,
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53 the second-level colleges under a medical school in Chongqing were divided into two
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55 strata of clinical and non-clinical categories(Clinical medicine is a specialty that will
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57 directly deal with diseases and patients and treat them directly in the future.
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4 non-clinical medical includes medical imaging, pharmacy, public health management,
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6 preventive medicine), and one class each from the first to the fourth year of each
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9 categories was selected to conduct a survey on influenza and influenza vaccine
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11 knowledge, attitudes, and practices to vaccinate. According to previous studies, the
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13 influenza vaccination rate of medical students is 9.2%, therefore, using the sample
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15 size calculation formula $N = \pi_0 (1 - \pi_0) \left(\frac{u\alpha + u\beta}{\delta} \right)^2$ (π_0 =vaccination rate, two-sided test
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17 level $\alpha=0.05$, test efficacy $\beta=0.10$, the tolerance error $\delta=0.05$) we can obtain a sample
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19 size of $n=351$, taking into account factors such as refusal, 400 each in the clinical and
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21 non-clinical categories, The total number of participants was 800 medical students.
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31 *Questionnaire*

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33 The questionnaire was developed, and a pilot study was conducted on a sample of
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35 30 participants. Feedback was used to modify the items, and the finalized instrument
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37 was administered electronically. Preventive measures advertised by the National
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39 Health Commission of the PRC on its official website were employed to assess the
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41 precautionary behavior. The survey consisted of two parts. The first part collected
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43 demographic information on the profession, gender, and ethnicity. The second part
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45 included knowledge about influenza and the influenza vaccine and attitude toward
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47 influenza vaccine—questionnaire with a Cronbach's alpha coefficient of over 0.7.
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57 *Ethical approval*

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59 This experiment only required the design of a questionnaire with cell phone data,
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4 which met the ethical approval exemption requirements of the Ethics Committee of
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6 Chongqing Medical University, and therefore did not require ethics committee
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8 approval. Data collection procedures were in accordance with institutional and
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10 national ethical guidelines and followed the Declaration of Helsinki. Data anonymity
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12 and confidentiality were maintained, and written informed consent was obtained from
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16
17 the investigators for this experiment.

22 *Survey*

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24 Influenza-related knowledge was scored 1 point for a correct answer and 0 points
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26 for a wrong answer, out of 23 points, and ≥ 14 points were judged as knowledge[9].
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28
29 Influenza vaccine knowledge rate (%) = number of correct answers/total number of
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31 respondents $\times 100\%$. Regarding the attitude toward the influenza vaccine, a total of
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33 45 points were assigned according to the attitude toward the influenza vaccine
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35 (5=very positive, 4=positive, 3=fair, 2=negative, 1=very negative), and ≥ 27 points
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37 were judged as positive toward influenza vaccine and vice versa. Influenza
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39 vaccination rate (%) = number of influenzas vaccinated/total number of surveyed \times
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41 100%. Influenza vaccination willingness rate (%) = number of people willing to
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43 receive influenza vaccination/total number of people surveyed $\times 100\%$.
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53 *Data analysis*

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56 Epidata 3.0 software was used for double data entry, and R 3.2.5 software was used
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58 for statistical analysis; the differences between means were tested by T-test. The
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4 differences between rates were analyzed by chi-square test, and unconditional logistic
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6 stepwise regression analysis was used for influencing factors of influenza vaccination
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9 intention, and differences were considered statistically significant at $P < 0.05$.

14 *Patient and Public Involvement statement*

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17 Patients were not involved in the design or conduct of this study, and nor were
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19 members of the general public.
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24 **Results**

29 *Demographics*

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32 A total of 803 medical students were surveyed, of whom 294 (36.61%) were
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34 male, and 509 (63.39%) were female; 394 (49.06%) were urban residents, and 409
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36 (50.04%) were rural residents; 720 (89.7%) were Han ethnic group, and 83(10.34%)
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38 were others ethnic group; in terms of Median Household Income, 208 (25.90%) were
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40 below 2000, 299 (37.24%) were 2001-4000, 152 (18.93) were 4001-6000, and 144
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42 (17.93%) were above 6000; 503 (62.6%) people in clinical majors and 300 (37.4%)
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44 people in non-clinical majors; 12 (1.5%) people were suffering from chronic diseases
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46 and 791 (98.5%) people were not suffering from chronic diseases(Table 1.).
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56 Table 1. Demographic characteristics of the study participants among clinical and
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58 non-clinical medical students in Chongqing, May to June 2019 (N=803)
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Demographic information	Clinical medical	Non-clinical medical	Total	P
Sex				
Male	179	115	294	0.434
Female	324	185	509	
Account Location				
City	226	168	394	0.002
Rural	277	132	409	
Ethnicity				
Han	456	261	720	0.058
Others	44	39	83	
Median Household Income				
<¥2000	135	73	208	0.494
¥2001-4000	184	115	299	
¥4001-6000	100	52	152	
>¥6001	84	60	144	
Whether have a chronic disease				
Yes	4	8	12	0.034
No	499	292	791	
Whether have medical insurance				
Yes	483	278	761	0.039
No	20	22	42	

Knowledge

The knowledge rate of clinical medical students about influenza and influenza vaccines was 66.64%, while the non-clinical knowledge rate was 58.03%. The most significant number of students answered, "Can influenza be transmitted by droplets?" accounting for 97.8%, while the smallest number answered, "How long do droplets with influenza virus generally remain toxic in the air?", accounting for 15.2%. The awareness rate of clinical students was significantly higher than that of non-clinical students on the questions "Are influenza and the common cold the same disease?", "Is the flu only contagious after the onset of symptoms?" and "side effects of influenza vaccine (fever, pain, and swelling at the injection site)" ($p < 0.05$)? On the contrary, the non-clinical students knew more about the questions "Should the flu vaccine be given within a specific period of time?" and "the priority group for influenza vaccination (medical personnel)" ($p < 0.05$) (Table 2.).

Table 2. Awareness of influenza and influenza vaccine among medical students in Chongqing, May to June 2019 (N=803).

Knowledge	Awareness Rate (n/N*100%)			p
	Totality	Clinical medical	Non-clinical medical	
Can droplets transmit influenza?	97.8	98.4	96.7	0.11

Does wearing a regular mask prevent the spread of influenza?	87.0	86.5	88.0	0.54
Are influenza and the common cold the same disease?	90.3	92.2	87.0	0.02
Influenza incubation period	24.0	24.3	23.7	0.85
Can influenza be transmitted in close proximity?	65.4	63.8	68.0	0.23
Is the flu only contagious after the onset of symptoms?	87.9	90.0	84.3	0.02
Will you still get the flu after receiving the flu vaccine?	85.9	84.3	88.7	0.08
How long do droplets with influenza virus generally remain toxic in the air?	15.2	15.7	14.3	0.60
Are systemic flu vaccine side effects rare?	66.0	44.1	49.0	0.18
Should the flu vaccine be given within a specific period of time ?	59.5	56.2	65.0	0.01
Is the flu vaccine likely to contain many harmful chemical elements ?	54.7	55.1	54.0	0.77
Is naturally developed immunity through influenza better than influenza vaccination ?	46.5	45.9	47.3	0.70
Best dates for flu vaccination	51.3	51.1	51.7	0.88

How often should you get the flu vaccine?	37.0	36.2	38.3	0.54
Purpose of influenza vaccination	91.3	90.4	92.7	0.28
Influenza vaccine side effects:				
Fever	67.2	72.2	59.0	<0.01
Pain and swelling at the injection site	83.7	87.1	78.0	<0.01
Headaches	55.8	56.3	55.0	0.73
Influenza vaccination priority groups:				
People over 60 years old	71.9	73.6	69.0	0.16
Patients with chronic diseases and infirmity	87.8	88.3	87.0	0.59
Medical Staff	89.0	85.3	91.3	<0.01
Elementary school students and kindergarten children	88.9	90.3	86.7	0.12
Pregnant	44.8	45.3	44.0	0.71
Average value	—	66.64%	58.03%	—

Attitudes

More non-clinical students thought the flu vaccine was safe (67.0%>64.0%) and necessary (71.3%>64.4%), but clinical students were also more concerned about flu vaccine side effects (78.0%>69.0%); clinical students were less confident about the effectiveness of the flu vaccine (58.4%<66.0%)(Table 3.).

Table 3. Attitudes toward influenza vaccine among clinical and non-clinical medical students in Chongqing, May to June, 2019 (N=803).

Attitude	n		% (n/N*100%)	
	Clinical medical	Non-clinical medical	Clinical medical	Non-clinical medical
Do you think the flu vaccine is safe?				
Safe	322	201	64.0	67.0
Unsafe	181	99	36.0	33.0
Do you think flu vaccination is necessary?				
Necessary	324	214	64.4	71.3
Unnecessary	179	86	35.6	28.7
Your side effects of the flu vaccine:				
Worried	392	207	78.0	69.0
Not worried	111	63	22.0	31.0
How effective do you think the seasonal flu vaccine is:				
Effective	209	102	41.6	34.0
Invalid	294	198	58.4	66.0
I do not need a flu vaccination because I have never had the flu:				

Agree	365	223	72.6	74.3
Disagree	138	77	27.4	25.7
Influenza can still occur after receiving the flu vaccine:				
Agree	67	60	13.3	20.0
Disagree	436	240	86.7	80.0
Annual flu vaccination is important to me:				
Important	414	233	82.3	77.7
Unimportant	89	67	17.7	22.3
What do you think your chances are of getting the flu if you don't get the flu shot this year?				
Possible	439	259	87.3	86.3
Impossible	64	41	12.7	13.7

Practices

184 (22.9%) medical students actively learn about the vaccine, mainly through TV, newspapers, or media (48.6%); health-care professionals (37.2%); classmates, friends, relatives, or neighbors (11.5%). During the 2018-2019 influenza season, 54 medical students were vaccinated against influenza, with a vaccination rate of 6.72% (54/803), including 26 clinical students with a vaccination rate of 5.17% (26/503) and 28

non-clinical students with a vaccination rate of 10.71% (28/300). The main reasons for influenza vaccination of clinical and non-clinical medical students versus the main reasons for not receiving influenza vaccination are shown in Figure 1 and Figure 2

Fig. 1 Main reasons for influenza vaccination for Clinical and Non-clinical medical students in Chongqing

Fig. 2 The main reason why Chongqing Clinical and Non-clinical medical students are not vaccinated against influenza

Multifactor analysis

Univariate analysis of factors influencing Clinical and Non-clinical medical student's willingness to receive the vaccination The results of the univariate analysis showed that the knowledge about influenza and influenza vaccine, positive attitude towards influenza vaccine, and whether they would take the initiative to learn about influenza vaccine-related information might be factors influencing medical students to receive influenza vaccination ($p < 0.05$)(Table 4.).

Table 4. Single-factor analysis of vaccination intention of medical students in Chongqing, May to June, 2019 (N=270).

Variables	Number of people willing to be	Intention rate of vaccination	X ²	P

	vaccinated	(%)		
Sex				
Male	91	31.0	1.48	0.22
Female	179	35.2		
Account Location				
City	134	34.0	0.05	0.82
Rural	136	33.3		
Ethnicity				
Han	238	33.1	1.01	0.32
Others	32	38.6		
Median Household Income				
<¥2000	73	35.1		
¥2001-4000	102	34.1	1.41	0.70
¥4001-6000	45	29.6		
>¥6001	50	34.7		
Specialty				
Clinical medical	169	33.6	<0.01	0.98
Non-clinical medical	101	33.7		
Will you be proactive in learning about flu vaccine information:				
Yes	81	44.3	12.02	<0.01

No	189	30.5		
Whether or not you received a flu vaccination in the past year:				
Yes	22	40.7	1.31	0.25
No	248	33.1		
Whether suffering from chronic diseases:				
Yes	5	33.5	0.35	0.55
No	265	41.7		
Knowledge of influenza and influenza vaccine				
Know	198	37.1	8.82	<0.01
Unknown	72	26.7		
Attitude toward flu vaccine				
Positive	263	35.7	17.59	<0.01
Negative	7	10.4		

Multifactor analysis of factors influencing the willingness of Clinical and Non-clinical medical students to receive the vaccination A dichotomous uncathegorical unconditional logistic stepwise regression analysis was performed with the five statistically significant factors in the univariate as independent variables and willingness to get influenza vaccination as dependent variables(0=unwilling,

1=willingly). The results of the multifactorial analysis showed that for non-clinical students, medical students who were aware were more willing to receive the influenza vaccine than those who were not aware of influenza and influenza vaccine-related knowledge (OR=2.23, 95% CI:1.28-3.98); those who were actively informed about the vaccine were more willing to receive Influenza vaccine (OR=2.08, 95% CI:1.20-3.16). For clinical students, female medical students (OR=1.55, 95% CI:1.03-2.33) and non-smoking medical students (OR=2.39, 95% CI:1.22-4.74) were more likely to get the influenza vaccine. Medical students with positive attitudes were more likely to get the influenza vaccine compared to those with negative attitudes toward the influenza vaccine (OR=4.17, 95% CI:1.75-12.34). (Table 5 and Table 6)

Table 5. Multifactor analysis of vaccination intention of Non-clinical medical students in Chongqing, May to June 2019 (N=303)

Variables	Compare	β	P	OR	95% CI	
					lower	upper
Awareness						
			<0.001			
Know	Unknown	0.80	0	2.23	1.28	3.98
Whether to proactively learn about flu vaccine information						
			1			

Yes No 0.73 <0.01 2.08 1.20 3.61

Table 6. Multi-factor analysis of vaccination intention of Clinical medical students in Chongqing, May to June, 2019 (N=500)

Variables	Compare	β	P	OR	95% CI	
					lower	upper
Sex						
			<0.			
Male	Female	0.44	0	1.55	1.03	2.33
			5			
Smoking or not						
No	Yes	0.87	<0.05	2.39	1.22	4.74
Attitude						
Positive	Negative	1.43	<0.01	4.17	1.75	12.34

Discussion

This study shows that the influenza vaccination rate of medical students in this medical school was only 6.7% in the 2018-2019 influenza season, which is lower than the vaccination level of medical students in other cities in China such as Urumqi (in the year 2009, 2010 and 2011 were 4.1%, 9.2%, and 6.1%)[6], and much lower than

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4 the vaccination level of medical students in developed countries such as Australia
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6 (36.3%)[11] and the United States (27.8%)[12]. This laterally reflects that the
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8 influenza vaccination level of medical students in Chongqing is low and needs to be
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10 further improved, and it is recommended that medical students are included in the
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12 priority recommended vaccination targets for influenza vaccination.
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17 In terms of knowledge acquisition, the overall knowledge of influenza and
18
19 influenza vaccine among students at the university was 66.4%, which indicates that
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21 more than 30% of the survey respondents did not know about influenza and influenza
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23 vaccine. Less than a quarter knew about the incubation period of influenza and the
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25 duration of influenza droplets in the air. Some studies have found that university
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27 education positively affects influenza knowledge[6], which means that students at the
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29 university do not pay much attention to influenza-related courses. The knowledge rate
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31 of clinical students was significantly higher than that of non-clinical students
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33 regarding the influenza disease itself, such as "Are influenza and the common cold the
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35 same disease?", "Is the flu only contagious after the onset of symptoms?" and side
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37 effects of influenza vaccine (fever, pain, and swelling at the injection site)? On the
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39 contrary, non-clinical students had a higher awareness of vaccination-related issues
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41 such as "Should the flu vaccine be given within a specific period of time?" and the
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43 priority groups for influenza vaccination (medical personnel). This is related to their
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45 education in degree programs, where clinical students learn more about the diagnosis
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47 and treatment of diseases, while non-clinical students focus more on the prevention
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49 and control of student diseases, which involves vaccination policies, vaccination
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4 protocols, etc.
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6 The primary reason for influenza vaccination among students of both majors was to
7 "strengthen resistance and prevent influenza," which is consistent with other studies
8 [13-15], suggesting that concern for one's own health is a driving factor for influenza
9 vaccination in this group. The rate of influenza vaccination among non-clinical
10 students (10.71%) was much higher than that of clinical students (5.17%), which was
11 the opposite of what we had expected. According to the analysis of the obtained data,
12 although clinical students considered it necessary to receive an influenza vaccine
13 (82.3%), the depth of their own knowledge about influenza vaccine was greater than
14 that of non-clinical students, which led to great distrust of the safety of influenza
15 vaccine (78%>69%). It is recommended that health education on the safety of
16 influenza vaccines should be strengthened for clinical students.
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35 Among students who reported not receiving the influenza vaccine, there was little
36 difference in the reasons for non-vaccination among clinical and non-clinical students,
37 with a significant percentage of both students believing that vaccination was not
38 necessary, suggesting that the influenza vaccine is not being taken seriously by this
39 group. It is noteworthy that 46.54% of clinical majors and 46.54% of non-clinical
40 majors have "never heard of influenza vaccine", which indicating that influenza
41 vaccination education at the school is not in place. It is recommended that health
42 education on influenza and influenza vaccination be strengthened, such as holding
43 competitions on influenza and influenza vaccine knowledge and providing specific
44 training on influenza vaccination in degree programs. Vaccine safety was the least
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4 influential factor impeding vaccination, indicating solid expertise among study
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6 participants. The results of the current study suggest that providing information
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8 beyond expertise to study subjects could help improve vaccine coverage.
9
10

11 In this study, it was found that students with more knowledge about the influenza
12
13 vaccine were more inclined to receive influenza vaccination, which is consistent with
14
15 previous studies [16]. While the difference between clinical and non-clinical students
16
17 regarding their willingness to receive influenza vaccination was not significant,
18
19 according to the multifactorial analysis, it was found that non-clinical students who
20
21 knew about influenza vaccine and those who actively learned about influenza
22
23 vaccine-related to it were more willing to receive the vaccine. Thus, the main factor
24
25 that influences non-clinical students to get vaccinated is the level of knowledge about
26
27 the influenza vaccine, so we should increase the promotion of the influenza vaccine
28
29 for non-clinical students. Among the clinical students, female and non-smoking
30
31 students were more willing to receive the vaccine, so we should increase the
32
33 promotion of the vaccine for male and smoking students.
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43 The main way to learn about the flu vaccine is through TV, newspapers or the
44
45 media. According to the report released by China Internet Network Information
46
47 Center [16], cell phones have become the number one Internet terminal, and the usage
48
49 rate of cell phones among college students is high. Some studies have shown that
50
51 female students, natural life sciences and medicine, social sciences and management,
52
53 and those with a monthly cell phone package costing \$4 or more are highly dependent
54
55 on cell phones[17-18]. Therefore, combining new media with old media can be more
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4 effective in spreading health information about influenza and its vaccine.
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8 9 *Implications of the findings*

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11 Most of the current papers analyze and compare medical students as a group, but
12 we refine the types of medical students: clinical medicine and non-clinical medicine.
13
14 By comparing the analysis of the factors of willingness to vaccinate for influenza
15 between the two groups, different promotional measures are taken for different groups
16 of people in different specialties. This will provide a scientific basis for more
17 effectively increasing the influenza vaccination rate among medical students and
18 strengthening influenza prevention and control.
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32 *Limitations*

33
34 However, this study has certain limitations; the data was collected using a
35 self-reported questionnaire, which can be a potential cause of reporting bias.
36
37 Moreover, since data is collected from medical students, so there is a possibility that
38 they might answer the question positively on the basis of their medical knowledge as
39 they already perceive what is expected from them. Another limitation is that data was
40 collected online through social networking platforms. There is a possibility of bias as
41 we may not be able to approach the students with an internet connectivity issue.
42
43 Because our study was conducted at a medical school in Chongqing, it may limit the
44 generalizability of the study, and we will subsequently expand the sample source in
45 the hope of obtaining better results.
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4 Since 2020, the COVID-19 pandemic has spread enormous information about
5
6 viruses in general, and medical students, in particular, would have had more
7
8 opportunities to study infectious diseases than before. Our study started before this
9
10 time, so our existing conclusions may have changed, and we will conduct a new round
11
12 of investigations as soon as possible to refine our experiments.
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19 **Conclusion**

20
21
22 Excessive concerns about vaccine safety are a major barrier to influenza
23
24 vaccination for clinical medical students, and a major barrier to influenza vaccination
25
26 for non-clinical medical students is the low prevalence of knowledge about vaccine
27
28 safety. Vaccine safety education should be provided to male and smoking clinical
29
30 medical student populations and non-clinical medical student populations in a
31
32 combination of old and new media.
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40 **Author Contributions**

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43 YLW and XJT drafted the manuscript. LG and QWL designed the
44
45 Questionnaire ;YLW and FZ collected the data; YLW, LG, QWL and FZ participated
46
47 in data analysis and data extraction. YLW and XJT finalized the manuscript. All
48
49 authors read and approved the final manuscript.
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58 **Funding**

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4 This research received no external funding.
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9 **Conflicts of Interest**

10
11 The authors declare no conflict of interest.
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14 **Data sharing**

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16 No additional data available
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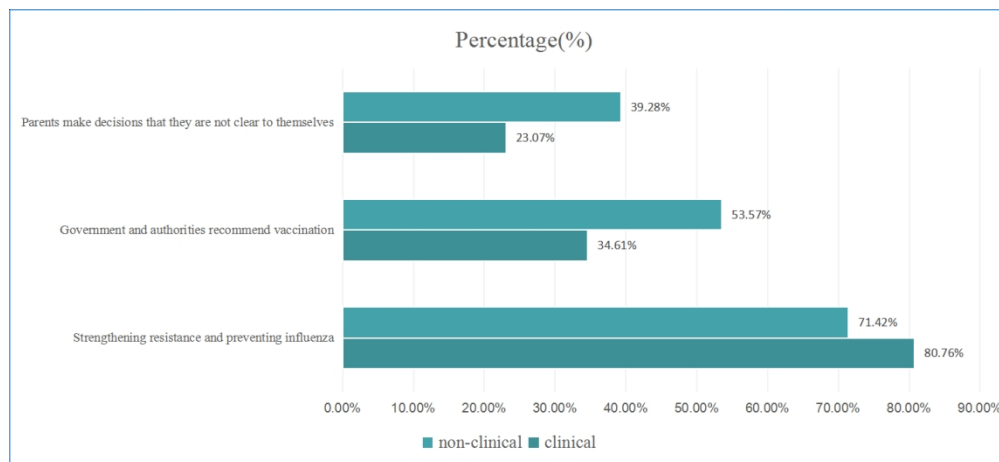


Fig. 1 Main reasons for influenza vaccination for Clinical and Non-clinical medical students in Chongqing

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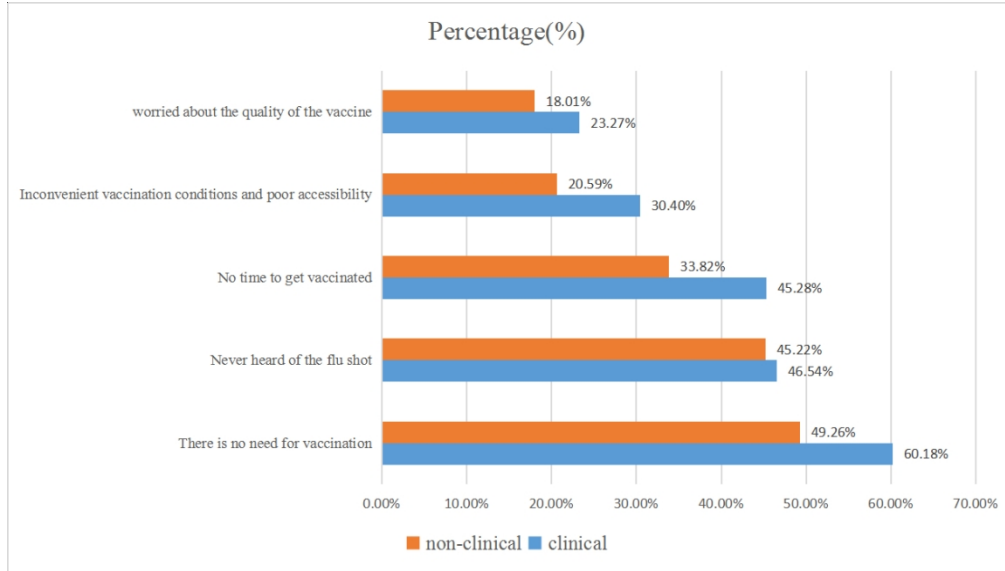


Fig. 2 The main reason why Chongqing Clinical and Non-clinical medical students are not vaccinated against influenza

538x306mm (59 x 59 DPI)

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1-2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5-6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7
Bias	9	Describe any efforts to address potential sources of bias	7
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5-6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7
		(b) Describe any methods used to examine subgroups and interactions	7
		(c) Explain how missing data were addressed	
		(d) If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	7
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8-9
		(b) Give reasons for non-participation at each stage	8-9
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8-9
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	8-17
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-17

		(b) Report category boundaries when continuous variables were categorized	8-17
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	8-17
Discussion			
Key results	18	Summarise key results with reference to study objectives	19-21
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	22-23
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	23
Generalisability	21	Discuss the generalisability (external validity) of the study results	21-23
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	24

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Does COVID-19 have an effect on influenza vaccine knowledge, attitude and practice among medical students: a two-year Prospective cohort study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-055945.R1
Article Type:	Original research
Date Submitted by the Author:	01-Mar-2022
Complete List of Authors:	Wang, Yunlong; Chongqing Medical University Wu, Guangjie; Chongqing Medical University, School of Public Health and Management Jiang, Yueming; Chongqing Medical University, Clinical 5+3 integration, the second clinical school Zou, Fa; Chongqing Medical University Gan, Lin; Chongqing Medical University Luo, Qinwen; Chongqing Medical University Tang, Xiaojun; Chongqing Medical University
Primary Subject Heading:	Epidemiology
Secondary Subject Heading:	Public health
Keywords:	Epidemiology < INFECTIOUS DISEASES, Public health < INFECTIOUS DISEASES, IMMUNOLOGY, COVID-19

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4 1 **Does COVID-19 have an effect on influenza vaccine**
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14 5 Yunlong Wang^{a,#},Guangjie Wu^{b,#}, Yueming Jiang^c, Fa Zou^a, Lin Gan^b,
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7 **ABSTRACT**

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9 26 *Objective* To explore the main factors affecting the knowledge ,attitude and practice
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11 27 about influenza and influenza vaccine and the intention to receive influenza
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14 28 vaccination among the same group of medical students before (2019) and after (2021)
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17 29 the COVID-19 outbreak.

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19 30 *Methods* A prospective cohort study has been conducted among undergraduate
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22 31 medical students in Chongqing, which includes a survey of influenza and influenza
23
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25 32 vaccine knowledge, attitudes, practice, and vaccination intentions between September
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28 33 2019 and October 2019.And a return visit to those who had previously received the
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31 34 questionnaire has been completed in November 2021.

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33 35 *Results* The influenza vaccination rate of students at this medical school is 6.7% in
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35 36 2019, compared with 25.8% in 2021.The awareness rate of medical students about
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38 37 influenza and influenza vaccine was 82.8% in 2019 and 86% in 2021, and there was
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41 38 no significant statistical difference between the two years($P=0.134>0.05$); the number
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44 39 of medical students with supportive attitude towards influenza vaccine was 95.1% in
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47 40 2019 and 97.1% in 2021, and there was no significant statistical difference between
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49
50 41 the two ($P= 0.078>0.05$); the number of people who actively learned about
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53 42 information related to influenza vaccine rose from 183 (22.8%) in 2019 to 195 (40.3%)
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56 43 in 2021.

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58 44 *Conclusion* The COVID-19 outbreak prompted an increase in influenza vaccination
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60 45 rates among medical students in Chongqing, with essentially everyone (96.0%)

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4 46 believing that the spread of COVID-19 promoted their knowledge of influenza and
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6 47 influenza vaccine, and the vast majority (74.8%) believing that the spread of
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9 48 COVID-19 promoted their willingness to receive influenza vaccine.
10

11 49 *Key words* Education,Flu,Immunization,Vaccine,Infection,COVID-19
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17 51 **Highlight**

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19
20 52 ·The COVID-19 outbreak prompted an increase in influenza vaccination rates among
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22 53 medical students in Chongqing

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24 54 ·Students who are more knowledgeable about the influenza vaccine and are actively
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27 55 learning about respiratory viral infectious diseases during COVID-19 transmission are
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30 56 more likely to get the influenza vaccine.
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37 59 **Background**

40 60 Influenza (influenza for short), a respiratory tract infectious disease, is extremely
41
42 61 contagious.Influenza virus antigenicity is variable and spreads rapidly.This virus can
43
44 62 cause seasonal epidemics each year.[1].Among them, China's Influenza Treatment
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47 63 Program (2020 version) clearly states that "annual influenza vaccination is the most
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50 64 effective means of influenza prevention, reducing the risk of influenza and serious
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53 65 complications in vaccinated individuals"[2].During the outbreak of pandemic
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56 66 Coronavirus disease 2019 (COVID-19), the Chinese Ministry of Health considers
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59 67 influenza vaccination for 2020-2021 to be particularly important[3]. Influenza
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4 68 vaccination has become especially important as the severe global epidemic of
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6 69 COVID-19 will continue this year and there may be a superimposed epidemic of
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9 70 COVID-19 epidemic with influenza and other respiratory infectious diseases this
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12 71 winter and next spring.

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14 72 At a place where students gather, the relatively crowded learning and living
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16
17 73 environment of schools are prone to influenza, and college students are highly mobile
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20 74 between campuses. Surveillance data from several provinces in recent years have
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23 75 shown that more than 90% of influenza each year occurs on campus [4]. Medical
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26 76 students, however, are at higher risk of influenza illness than other college students
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29 77 due to the specificity of their discipline. They are the future medical workers and
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32 78 important disseminators of health knowledge, and there is an excellent need for
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35 79 vaccination[5].

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38 80 Little has been reported on the current status of influenza vaccination in this group in
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41 81 China. From the few studies, it was found that the current vaccination rate of medical
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44 82 students in China is much lower than that of foreign countries. Influenza vaccination
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47 83 rates for medical students were 17.1% in northwest China, 25.3% in Brazil, 20.7% in
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50 84 Saudi Arabia, 53.8% in Australia, 76% in the United Kingdom, and 43% in the United
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53 85 States[4,6-10]. To explore whether medical students' knowledge, attitude and practice
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56 86 about influenza and influenza vaccine have changed under the influence of today's
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59 87 COVID-19 epidemic, we compared the results of the survey on the knowledge and
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88 beliefs about influenza and influenza vaccine among the same group of medical
89 students before the outbreak (2019) and after the outbreak (2021) to explore the main

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4 90 factors affecting medical students' willingness to receive influenza vaccination, and to
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6 91 provide a scientific basis for improving influenza vaccination rates among medical
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9 92 students and strengthening influenza prevention and control efforts in the current
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12 93 context.

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17 95 **MATERIAL AND METHODS**

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22 97 *Study design and settings*

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25 98 In this prospective cohort study, a survey on influenza and influenza vaccine
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27 99 awareness and willingness to vaccinate was conducted among freshman-year to
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30 100 senior-year medical students in a medical school in Chongqing from September 2019
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32 101 to October 2019, and the questionnaire was named Q1. A new survey on influenza and
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35 102 influenza vaccine knowledge, attitude and practice to vaccinate was sent by email to
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38 103 volunteers who had previously received the questionnaire in November 2021, with
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40 104 some slight modifications due to the COVID-19 and the questionnaire was named
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43 105 Q2. The questionnaire data will be compiled and collected in January 2022. The final
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46 106 return rate of the questionnaire was only 60.27% due to graduation, email
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48 107 discontinuation, etc. All participants were randomly selected and volunteered to
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51 108 participate in this experiment and were not involved in the recruitment and conduct of
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54 109 the study.

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58 111 *Patient and public involvement*

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4 112 This research was done without patient involvement. Patients were not invited to
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6 113 comment on the study design and were not consulted to develop patient relevant
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9 114 outcomes or interpret the results. Patients were not invited to contribute to the writing
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11
12 115 or editing of this document for readability or accuracy.
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14 116

17 117 *Questionnaire*

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19 118 Both questionnaire (Q1 and Q2) was developed, and a pilot study was conducted on
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22 119 a sample of 30 participants. Feedback was used to modify the items, and the finalized
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25 120 instrument was administered electronically. Preventive measures advertised by the
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28 121 National Health Commission of the PRC on its official website were employed to
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30 122 assess the precautionary behavior. The survey consisted of two parts. The first part
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33 123 collected demographic information on profession and gender. The second part
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36 124 included knowledge about influenza and the influenza vaccine and attitude toward
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38 125 influenza vaccine—questionnaire with a Cronbach's alpha coefficient of over 0.7.
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43 127 *Ethical approval*

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45 128 Data collection procedures comply with institutional and national ethical guidelines
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48 129 and follow the Declaration of Helsinki. The anonymity and confidentiality of data is
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51 130 maintained. Written informed consent has been obtained from the investigators for
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54 131 this experiment.
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58 133 *Survey*

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4 134 We collated questions on influenza-related knowledge and influenza vaccine
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6 135 attitude from both Q1 and Q2 questionnaires and we analyzed them after excluding
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9 136 redundant and repetitive questions. Influenza-related knowledge was scored 1 point
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11 137 for a correct answer and 0 points for a wrong answer. The full score is 18 points and a
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14 138 score of ≥ 11 is judged as knowing. Influenza vaccine knowledge rate (%) = number
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17 139 of correct answers/total number of respondents $\times 100\%$. For influenza vaccine attitude,
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19 140 a score was assigned according to the attitude towards influenza vaccine (5=very
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21
22 141 positive, 4=positive, 3=fair, 2=negative, 1=very negative). And the full score is 25,
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24 142 and ≥ 15 points are judged as positive treatment of influenza. Vaccine vaccination
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27 143 rate (%) = number of influenzas vaccinated/total number of surveyed $\times 100\%$.
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30 144 Influenza vaccination willingness rate (%) = number of people willing to receive
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33 145 influenza vaccination/total number of people surveyed $\times 100\%$.

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38 147 *Data analysis*

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40 148 Epidata 3.0 software was used for double data entry, and R 3.2.5 software was used
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43 149 for statistical analysis; the differences between means were tested by T-test. The
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46 150 differences between rates were analyzed by chi-square test, and unconditional logistic
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49 151 stepwise regression analysis was used for influencing factors of influenza vaccination
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51 152 intention, and differences were considered statistically significant at $P < 0.05$.

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55 154 **Results**

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4 156 *Demographics*
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7 157 A total of 803 medical students participated in this survey between September
8
9 158 and October 2019. Only 484 medical students answered the questionnaire during the
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11 159 return visit in November 2021. We define freshmen, sophomores and juniors as lower
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13 160 division students, and Seniors and Fifth year students as senior group. In the
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15 161 comparison between 2021 and 2019, there are statistically significant differences in
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17 162 gross monthly income (GMI), age and grade level, and the specific information can be
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19 163 seen in Table 1.
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27 165 *Knowledge*
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30 166 The knowledge rate of medical students about influenza and influenza vaccine was
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32 167 82.8% in 2019 and 86% in 2021, and there was no statistically significant difference
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34 168 between the two comparisons ($P=0.134>0.05$). "Wearing a mask can prevent the
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36 169 spread of the flu to some extent.", "Incubation period of influenza", "Influenza can be
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38 170 spread through close contact with patients", "Influenza vaccination for immunity is
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40 171 less costly and more cost-effective than developing immunity from influenza
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42 172 infection", "The best time to get a flu vaccination", "How often should you get a flu
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44 173 vaccination?". The above six questions are significantly more known and statistically
45
46 174 significant in 2021 than in 2019, while the three questions: "Influenza patients can
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48 175 spread the infection before symptoms appear", "Influenza vaccination does not give
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50 176 you the flu although it carries live virus", and "What do you think the purpose of
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52 177 influenza vaccination is" are less known and statistically significant in 2021 than in
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4 178 2019(Table 2.).
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9 180 *Attitudes*
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11 181 The percentage of medical students who were supportive of influenza vaccine in
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13 182 2019 was 95.1% and 97.1% in 2021, with no statistically significant difference
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15 183 between the two comparisons ($P=0.078>0.05$).More medical students in 2021 than in
16
17 184 2019 believe the flu vaccine is safer ($91.5% > 65.1%$), that getting the flu vaccine is
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19 185 necessary ($83.9% > 67.0%$), that the seasonal flu vaccine is more effective in
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21 186 preventing seasonal flu ($86.8% > 73.2%$), and that getting the vaccine is more
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23 187 important ($59.3% > 43.1%$), but are also more concerned about side effects of the
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25 188 influenza vaccine ($56.0% > 25.5%$)(Table 3.).
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34 190 *Practices*
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37 191 The main source of influenza vaccine information in 2019 was television,
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39 192 newspapers, and the media (48.6%), while the main source in 2021 was health care
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41 193 professionals (35.6%)(Figure 1).
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45 194 The number of people actively seeking information about influenza vaccine rose
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47 195 from 183 (22.8%) in 2019 to 195 (40.3%) in 2021. The number of people who
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49 196 received influenza vaccination in 2021 was much higher than in 2019 ($25.8% > 6.7%$),
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51 197 and the most significant increase in adverse reactions to vaccination was seen in the
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53 198 phenomenon of temporary mild pain, redness and swelling at the injection site ($39.2%$
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55 199 $> 18.5%$). Among the reasons for receiving influenza vaccination: "to strengthen
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4 200 resistance and prevent influenza" (75.9%<88.8%) and "recommended by government
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6 201 and health authorities" (44.4%<72.0%), both of which are lower in 2019 than in
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9 202 2021(Table 4.).

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11 203 The three main reasons for not getting vaccinated in 2019 were "did not think it
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14 204 was necessary to get vaccinated" (53.8%), "did not know about the flu vaccine"
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17 205 (46.1%), and "did not have time " (41.1%). the three main reasons for not getting
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20 206 vaccinated in 2021 were: "didn't have time to get vaccinated" (43.5%), "didn't think it
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22 207 was necessary to get vaccinated" (43.2%), and "Didn't know about the flu vaccine"
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25 208 (35.9%)(Fig.2).

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27 209 During the COVID-19 epidemic in 2021, most people believed that the epidemic
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30 210 promoted awareness of influenza and influenza vaccine (96%) and willingness to
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33 211 receive influenza vaccination (74.8%)(Table 5.).

212 213 *Analysis of Single Factors Affecting Medical Students' Vaccination Intentions in 2021*

214 The vaccination rate of medical students who actively learned about influenza vaccine
215 was significantly higher than that of medical students who did not actively learn about
216 it (47.2% > 11.4%), and the vaccination rate of medical students who actively learned
217 and learned about respiratory viral infectious diseases during COVID-19 was also
218 higher than that of medical students who did not actively learn about it (29.5% >
219 8.3%)(Table 6.).

220

221 **Discussion**

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4 222 This study showed that the influenza vaccination rate of medical students in this
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6 223 medical school was only 6.7% in the 2019 influenza season, which is lower than the
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9 224 vaccination levels of medical students in other cities such as Urumqi, China (4.1%,
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11 225 9.2%, and 6.1% in 2009, 2010, and 2011, respectively) [6]. However, in 2021 the
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14 226 vaccination rate of medical students against influenza rose to 25.8%, which is not as
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17 227 high as the vaccination level of medical students in developed countries such as the
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19 228 United States and the United Kingdom, but it is also a significant improvement
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22 229 compared with 2019. This finding indicates that the COVID-19 outbreak has
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25 230 significantly boosted the influenza vaccination rate of medical students. However, the
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28 231 level of influenza vaccination among medical students in Chongqing is still low and
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30 232 needs to be further improved, and it is recommended that medical students be
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33 233 included in the key recommended vaccination targets for influenza vaccination.

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35 234 Looking at the demographic characteristics of the respondents, factors such as
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38 235 graduation and email abandonment resulted in a return rate of only 60.27%. the gross
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41 236 monthly income(GMI) in 2021 is higher than that in 2019, which we speculate may
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44 237 be due to inflation. Over time, the age and grade level in 2021 are higher than in 2019,
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47 238 which is also in line with the objective rule and our speculation.

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49 239 In terms of knowledge, there was no significant difference between the comparison
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52 240 of 2021 and 2019 ($p=0.134>0.05$). However, on average, only a quarter of the
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55 241 population knew the incubation period time of influenza, and one study found that
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58 242 university education has a positive impact on influenza knowledge [11], based on this,
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60 243 indicating that students at this university do not pay much attention to

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4 244 influenza-related courses. The percentages for "Wearing a mask can prevent the spread
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6 245 of influenza to some extent," "Influenza can be spread through close contact with
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9 246 patients," and "Compared to developing immunity from influenza infection, getting
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11 247 immunity from influenza vaccination is less cost and better cost-effectiveness", which
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14 248 are significantly more correct in 2021 than in 2019. This is because of the emergence
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17 249 of COVID-19, which is more widely known due to state and government campaigns
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19
20 250 and changes in daily lifestyle (e.g., the need to wear a mask when using public
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22 251 transportation). The question "side effects of influenza vaccination: fever, headache"
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24
25 252 was also better answered in 2021, probably due to the reactions that occurred during
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27 253 the vaccination with COVID-19 or the possible side effects that were told by doctors
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30 254 or teachers before the vaccination [12-13]. As for the question "chronically ill and
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32 255 frail people are the priority recommended population for influenza vaccination", the
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35 256 answer was reversely better in 2019 than in 2021 (87.8% > 82.6%), which we
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38 257 speculate may be due to the fact that at the time of vaccination during the COVID-19,
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41 258 it was considered that the resistance of these groups was weak and that the newly
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43 259 developed vaccine was not unsafe and did not recommend patients with chronic
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46 260 diseases and frail patients to receive the COVID-19 vaccine, thus leading to poorer
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48 261 answers to this question [14-16].

50 262 Regarding the comparison of attitudes towards influenza vaccine, although there
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53 263 was no significant difference between 2021 and 2019 ($p=0.078>0.05$), 2021
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56 264 respondents were more likely to believe that influenza vaccine is safe and important,
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59 265 that vaccination against influenza is necessary, and that they are not concerned about
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4 266 the side effects of influenza vaccine. There are good reasons to attribute this to the
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7 267 COVID-19 epidemic brought about by the Change.
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9 268 The most important reason for influenza vaccination among medical students in
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11 269 both 2021 and 2019 was "to increase resistance and prevent influenza", which is
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14 270 consistent with other studies [17-19], indicating that concern for one's health is the
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17 271 driving factor for influenza vaccination in this group. The reason "recommended by
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19 272 the government and health authorities" increased from 44.4% in 2019 to 72% in 2021,
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22 273 due to the government's strong call for people to get COVID-19 vaccine in the past
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25 274 year, which led to the group's increased interest in influenza vaccination.
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27 275 Among students who reported not receiving the influenza vaccine, the reasons for
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30 276 not receiving the vaccine in 2021 and 2019 are not very different, with a significant
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33 277 percentage of students not considering it necessary, suggesting that the influenza
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36 278 vaccine is not being taken seriously by this group. It is noteworthy that the number of
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38 279 students who have "never heard of influenza vaccine" reached 46.1% in 2019 and
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40 280 35.9% in 2021. It is recommended that health education on influenza and influenza
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43 281 vaccine be strengthened, such as holding a competition on influenza and influenza
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46 282 vaccine knowledge and providing specific training on influenza vaccination in degree
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48 283 programs. Vaccine safety was the least influential factor impeding vaccination,
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51 284 indicating solid expertise among study participants. The results of the current study
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54 285 suggest that providing information beyond expertise to study subjects could help to
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57 286 improve vaccine coverage.
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59 287 This study found that students with more knowledge about influenza vaccine were
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4 288 more inclined to receive influenza vaccine, which is consistent with previous studies
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6 289 [20]. Students who took the initiative to learn about respiratory viral infectious
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9 290 diseases during COVID-19 transmission were also more likely to get the influenza
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11 291 vaccine, suggesting that the promotion and dissemination of knowledge about
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14 292 COVID-19 also helped people to understand more about influenza and influenza
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17 293 vaccine. This shows that in the current environment, we should attach knowledge
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19 294 about influenza to the promotion of COVID-19-related knowledge and prevention
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22 295 methods, so that people can receive COVID-19 vaccination and also pay attention to
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25 296 influenza vaccination, thereby increasing the influenza vaccination rate.
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30 *Limitations*

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32 299 However, this study has certain limitations. The data was collected via using a
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35 300 self-reported questionnaire, which can be a potential cause of reporting bias.
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38 301 Moreover, since data is collected from medical students, there is a possibility that they
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41 302 might answer the question positively on the basis of their medical knowledge as they
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44 303 have already perceived what is expected from them. Another limitation is that data
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47 304 was collected online through social networking platforms. There is a possibility of
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50 305 bias as we may not be able to approach the students with an internet connectivity
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53 306 issue. Because our study was conducted at a medical school in Chongqing, it may
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56 307 limit the generalizability of the study, and we will subsequently expand the sample
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59 308 source in hope of obtaining better results.
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310 **Conclusion**

311 The COVID-19 outbreak prompted an increase in influenza vaccination rates
312 among medical students in Chongqing (6.7% in 2019 to 25.8% in 2021), with
313 essentially everyone (96.0%) believing that the spread of COVID-19 promoted their
314 knowledge of influenza and influenza vaccine, and the vast majority (74.8%)
315 believing that the spread of COVID-19 promoted their willingness to receive
316 influenza vaccine. We should promote COVID-19 vaccine along with the
317 dissemination of influenza vaccine-related knowledge to help increase influenza
318 vaccination rates.

320 **Author Contributions**

321 YLW and XJT drafted the manuscript. GJW and QWL designed the
322 Questionnaire ;YLW and FZ collected the data; GJW, LG, QWL , YMJ and FZ
323 participated in data analysis and data extraction. YLW and XJT finalized the
324 manuscript. All authors read and approved the final manuscript.

326 **Acknowledgments**

327 The authors thank all participants of this study for sharing their time and
328 experiences.

330 **Funding**

331 This research received no external funding.

332

333 **Conflicts of Interest**

334 The authors declare no conflict of interest.

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336 **Data availability statement**

337 Data are available upon reasonable request

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401 Table 1. Demographic characteristics of the study participants in Chongqing

Demographic information	2019	2021	Total	P
	n(%)	n(%)		
Gender				

Male	294 (36.6)	179 (37.0)	473	0.894
Female	509 (63.4)	305 (63.0)	814	
GMI				
<¥4000	507 (63.1)	275 (56.8)	782	0.025
≥¥4000	296 (36.9)	209 (43.2)	505	
Age				
18-20 years old	350 (43.6)	177 (36.6)	527	0.013
21-23 years old	453 (56.4)	307 (63.4)	760	
Grade Level				
Lower Division	167 (20.8)	39 (8.1)	206	<0.001
Senior group	636 (79.2)	445 (91.9)	1081	

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Table 2. Comparison of influenza vaccine knowledge in 2019 and 2021

Knowledge	Knowledge Awareness Level		
	2019	2021	P
	Awareness rate n (n/N*100%)	Awareness rate n (n/N*100%)	
Wearing a mask helps to prevent the spread of the flu	699 (87.0)	472 (97.5)	<0.001
Influenza is mainly spread	785 (97.8)	475 (98.1)	0.640

by respiratory (coughing,			
sneezing) droplets			
Incubation period of			
influenza	193 (24.0)	156 (32.2)	0.001
Influenza carriers (without			
symptoms) can spread the	706 (87.9)	391 (80.8)	0.001
infection			
Patients are contagious	525 (65.4)	439 (90.7)	<0.001
Influenza vaccination does			
not give you the flu despite	690 (85.9)	272 (56.2)	<0.001
carrying live virus			
Influenza vaccination for			
immunity is less costly and			
more cost-effective than	373 (46.5)	420 (86.8)	<0.001
developing immunity from			
influenza infection			
The best time to get			
vaccinated	412 (51.3)	310 (64.0)	<0.001
Frequency of vaccination	297 (37.0)	213 (44.0)	0.013
Perception of the aim of			
flu vaccination	733 (91.3)	422 (87.2)	0.020
Side effects of influenza			

vaccination			
Fever	540 (67.2)	364 (75.2)	0.002
Pain and swelling at the injection site	672 (83.7)	419 (86.6)	0.160
Headaches	448 (55.8)	318 (65.7)	<0.001
Influenza vaccination priority groups			
People over 60 years old	577 (71.9)	351 (72.5)	0.797
Patients with chronic illnesses and infirmity	705 (87.8)	400 (82.6)	0.011
Health facility staff, especially front-line staff	715 (89.0)	415 (85.7)	0.082
Pupils and kindergarten children	714 (88.9)	420 (86.8)	0.253
Pregnant women over the first trimester of pregnancy	360 (44.8)	192 (39.7)	0.069

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Table 3. Comparison of Influenza Vaccine Attitudes in 2019 vs. 2021

Attitude	2019	2021	P
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	n	% (n/N)	n	% (n/N)	
Flu vaccine is safe					
Agree	523	65.1	443	91.5	<0.001
Disagree	280	34.9	41	8.5	
Flu vaccination is necessary					
Agree	538	67.0	406	83.9	<0.001
Disagree	265	33.0	78	16.1	
You are not worried about the side effects of the flu vaccine					
Agree	205	25.5	271	56.0	<0.001
Disagree	598	74.5	213	44.0	
The seasonal flu vaccine is more effective in preventing seasonal flu					
Agree	588	73.2	420	86.8	<0.001
Disagree	215	26.8	64	13.2	
Annual flu vaccination is important for you					
Agree	346	43.1	287	59.3	<0.001
Disagree	457	56.9	197	40.7	
You are planning to get a flu vaccination this autumn/winter					
Agree	268	33.4	187	38.6	0.056
Disagree	535	66.6	297	61.4	

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Table 4. Comparison of influenza vaccination behaviour in 2019 vs.2021

Behaviour	2019		2021		P
	n	%(n/N)	n	%(n/N)	
Do you take the initiative to learn about the flu vaccine?					
Yes	183	22.8	195	40.3	<0.001
No	620	77.2	289	59.7	
Did you get a flu vaccination last year?					
Yes	54	6.7	125	25.8	<0.001
No	749	93.3	359	74.2	
Did you have any of the following adverse reactions in your last flu vaccination?					
Severe allergic reactions	7	13.0	23	18.4	0.362
Dizziness	9	16.7	26	20.8	0.483
Low fever	7	13.0	23	18.4	0.337
Transient mild pain, redness and swelling at the injection site	10	18.5	49	39.2	0.004
No adverse reactions	36	66.7	67	53.6	0.136
What are your reasons for getting the flu vaccine?					

Build up your resistance and prevent flu	41	75.9	111	88.8	0.033
Recommendation from government and health authorities	24	44.4	90	72.0	<0.001
Recommended by family and friends	17	31.5	58	46.4	0.061
Other	3	5.6	1	0.8	0.061
Have you had a flu-like illness within 1 year of vaccination?					
Yes	8	14.8	17	13.6	
No	25	46.3	96	76.8	<0.001
Don't remember	21	38.9	12	9.6	

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Table 5. Analysis of COVID-19 related behaviors in 2021 (frequency statistics)

COVID-19 Related Acts	Number of people	Percentage (%)
The COVID-19 outbreak promotes your learning about respiratory infectious diseases		
Yes	400	82.6
No	84	17.4
The COVID-19 outbreak raised your awareness of flu and flu vaccine.		
Yes	384	96.0
No	16	4.0

The COVID-19 Outbreak boosts your intention to get flu

vaccinated.

Yes	362	74.8
No	122	25.2

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420 Table 6. Analysis of factors influencing medical students' willingness to receive
421 vaccinations in 2021.

Variables	Number of people vaccinated (percentage%)	Number of unvaccinated persons (%)	OR value (95% CI)	P
Gender				
Male	49(27.4)	130(72.6)	1.136(0.747-1.726)	0.551
Female	76(24.9)	229(75.1)	Ref	
Age				
18-20	48(27.1)	129(72.9)	1.111(.7300-1.692)	0.622
21-23	77(25.1)	230(74.9)	Ref	
Grade Level				
Lower School	14(35.9)	25(64.1)	1.685(0.846-3.355)	0.137
Upper School	111(24.9)	334(75.1)	Ref	

GMI					
<¥4000	65(23.6)	210(76.4)	0.769(0.511-1.157)		
				0.207	
≥¥4000	60(28.7)	149(71.3)	Ref		
Attitudes towards the flu vaccine					
Negative	1(7.1)	13(92.9)	Ref		0.140
Active	124(26.4)	346(73.6)	4.659(0.603-35.984)		
Level of knowledge					
Understanding	13(19.1)	55(80.9)	Ref		0.443
Don't understand	112(26.9)	304(84.7)	1.559(0.820-2.962)		
proactive about information about flu vaccines					
Yes	92(47.2)	103(52.8)	6.929(4.380-10.963)		<0.001
No	33(11.4)	256(88.6)	Ref		
learning about respiratory infectious diseases during the COVID-19 outbreak					
Yes	118(29.5)	282(70.5)	4.603(2.062-10.275)		<0.001
No	7(8.3)	77(91.7)	Ref		

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Fig.1 Sources of Influenza Vaccine Information for 2019 vs. 2021

Fig. 2 Main reasons for not getting an influenza vaccination in 2019 vs. 2021

For peer review only

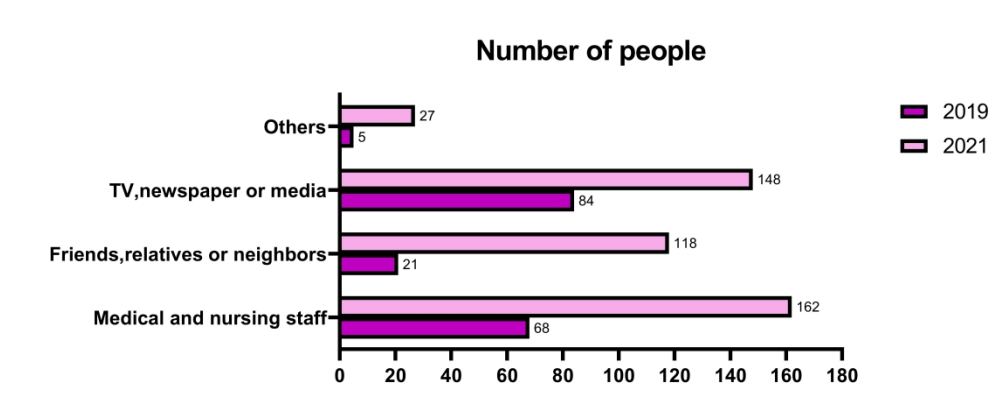
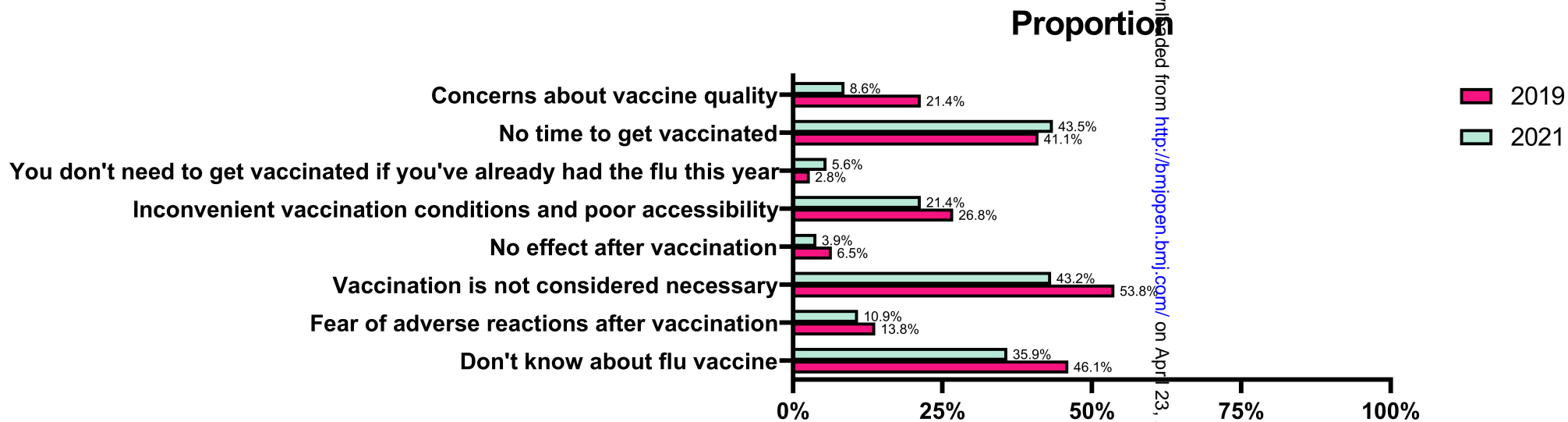


Fig. 1 Sources of Influenza Vaccine Information for 2019 vs. 2021

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STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1-2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5-6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7
Bias	9	Describe any efforts to address potential sources of bias	7
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5-6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7
		(b) Describe any methods used to examine subgroups and interactions	7
		(c) Explain how missing data were addressed	
		(d) If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	7
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8-9
		(b) Give reasons for non-participation at each stage	8-9
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8-9
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	8-17
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-17

		(b) Report category boundaries when continuous variables were categorized	8-17
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	8-17
Discussion			
Key results	18	Summarise key results with reference to study objectives	19-21
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	22-23
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	23
Generalisability	21	Discuss the generalisability (external validity) of the study results	21-23
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	24

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Does COVID-19 have an effect on influenza vaccine knowledge, attitude and practice among medical students: a two-year Prospective cohort study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-055945.R2
Article Type:	Original research
Date Submitted by the Author:	06-Jun-2022
Complete List of Authors:	Wang, Yunlong; Chongqing Medical University Wu, Guangjie; Chongqing Medical University, School of Public Health and Management Jiang, Yueming; Chongqing Medical University, Clinical 5+3 integration, the second clinical school Zou, Fa; Chongqing Medical University Gan, Lin; Chongqing Medical University Luo, Qinwen; Chongqing Medical University Tang, Xiaojun; Chongqing Medical University Wu, Xiaorong; Chongqing Medical University
Primary Subject Heading:	Epidemiology
Secondary Subject Heading:	Public health
Keywords:	Epidemiology < INFECTIOUS DISEASES, Public health < INFECTIOUS DISEASES, IMMUNOLOGY, COVID-19

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1 **Does COVID-19 have an effect on influenza vaccine**
2 **knowledge, attitude and practice among medical students: a**
3 **two-year Prospective cohort study**

4
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24 **ABSTRACT**

25 *Objectives* To explore the main factors affecting the knowledge, attitude and
26 practice about influenza and influenza vaccine as well as the intention to receive
27 influenza vaccination among the same group of medical students before (2019) and
28 after (2021) the COVID-19 outbreak.

29 *Design* A population-based prospective cohort study.

30 *Setting* A longitudinal cohort study of a selected medical school in Chongqing,
31 China, which ran from 2019 to 2021.

32 *Participants* A total of 803 medical students participated in the study in 2019 and
33 only 484 students responded in 2021. The response rate for our survey was only 60.27%
34 due to graduation, emails being abandoned, etc.

35 *Results* The influenza vaccination rate of students at this medical school was 6.7% in
36 2019, compared with 25.8% in 2021. The awareness rate of medical students about
37 influenza and influenza vaccine was 82.8% in 2019 and 86% in 2021, and there was no
38 significantly statistical difference between the two years ($p = 0.134$); the number of
39 medical students with supportive attitude towards influenza vaccine was 95.1% in 2019
40 and 97.1% in 2021, and there was no statistically significant difference between the two
41 ($p = 0.078$); the number of students who actively learned about knowledge related to
42 influenza vaccine rose from 183 (22.8%) in 2019 to 195 (40.3%) in 2021.

43 *Conclusions* The COVID-19 outbreak prompted an increase in influenza vaccination
44 rates among medical students in Chongqing, with almost all students (96.0%) believing
45 that the spread of COVID-19 promoted their knowledge in influenza and influenza

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4 46 vaccine, and the vast majority (74.8%) believing that the spread of COVID-19
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7 47 promoted their willingness to receive influenza vaccine.
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9 48 *Key words* Education, Flu, Immunization, Vaccine, Infection, COVID-19
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13 14 50 **Strengths and limitations of this study**

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16
17 51 ·Comparing knowledge attitude and practice toward influenza vaccine in the same
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20 52 group before and after the COVID-19 outbreak, and this condition cannot be replicated
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22 53 now.

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25 54 ·Because our study was conducted at a medical school in Chongqing, it may limit the
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27 55 generalizability of the study.
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30 56 31 32 57 **Background**

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35 58 Influenza (or flu), a respiratory tract infectious disease, is extremely contagious.
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37
38 59 Influenza virus antigenicity is variable and spreads rapidly.This virus can cause
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41 60 seasonal epidemics each year.[1].Among them, China's Influenza Treatment Program
42
43 61 (2020 version) clearly states that "annual influenza vaccination is the most effective
44
45 62 means for influenza prevention, reducing the risk of influenza and serious
46
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48 63 complications in vaccinated individuals"[2].During the outbreak of pandemic
49
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51 64 Coronavirus disease 2019 (COVID-19), the Chinese Ministry of Health considers
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53 65 influenza vaccination for 2020-2021 to be particularly important[3]. Influenza
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56 66 vaccination has become especially important as the severe global epidemic of COVID-
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59 67 19 will continue this year and there may be a superimposed epidemic of COVID-19
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4 68 epidemic with influenza and other respiratory infectious diseases this winter and next
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6 69 spring.

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9 70 As a place where students frequently gather, the relatively crowded learning and
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11 71 living environment of schools makes it easy for students to catch the flu, and college
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13 72 students are highly mobile between campuses. Surveillance data from several provinces
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15 73 in recent years have shown that more than 90% of influenza each year occurs on
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17 74 campus. From 2004-2008, 90.48% of influenza outbreaks in Jiangsu Province occurred
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19 75 on campus. From 2006-2013, 97.26% of influenza outbreaks in Shanxi Province also
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21 76 occurred on campus[4-6]. Among all the students on campus, medical students are
22
23 77 believed to possess a higher risk of influenza illness than other students due to the
24
25 78 specificity of their discipline. They are the future medical workers and important
26
27 79 disseminators of health knowledge, so there is a need for vaccination for them[7].

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30 80 However, little has been reported regarding the current status of influenza vaccination
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32 81 in this group in China. From the few studies, it was found that the current vaccination
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34 82 rate of medical students in China was much lower than that of foreign countries.
35
36 83 Influenza vaccination rates for medical students were 17.1% in northwest China, 25.3%
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38 84 in Brazil, 20.7% in Saudi Arabia, 53.8% in Australia, 76% in the United Kingdom, and
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40 85 43% in the United States[4,8-13]. To explore whether medical students'
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42 86 knowledge, attitude and practice about influenza and influenza vaccine have changed
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44 87 under the influence of today's COVID-19 epidemic, we compared the results of a survey
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46 88 on their knowledge in and beliefs about influenza and influenza vaccine among the
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48 89 same group of medical students before the outbreak (2019) and after the outbreak (2021)
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4 90 to 1) investigate the main factors affecting medical students' willingness to receive
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6 91 influenza vaccination; 2) provide a scientific basis for improving influenza vaccination
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9 92 rates among medical students and strengthening influenza prevention and control
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12 93 efforts in the current context.
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17 95 **MATERIAL AND METHODS**

19 96 20 97 *Study design and settings*

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22 98 In this prospective cohort study, a survey study focusing on influenza and influenza
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24 99 vaccine awareness and willingness to vaccinate was first conducted among freshman-
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27 100 year to senior-year medical students in a medical school in Chongqing, China from
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31 101 September 2019 to October 2019, and the questionnaire used was named Q1. A new
32
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34 102 survey on influenza and influenza vaccine knowledge, attitude and practice to vaccinate
35
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37 103 with some slight modifications due to the COVID-19 was sent by email to volunteers
38
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40 104 who had previously received the questionnaire (Q1) in November 2021, and the new
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43 105 questionnaire was named Q2. The questionnaire data will be compiled and collected in
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46 106 January 2022. The final return rate of the questionnaire was only 60.27% due to
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48 107 graduation, email discontinuation, etc. All participants in 2019 were randomly selected
49
50
51 108 and volunteered to participate in this experiment and were not involved in the conduct
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54 109 of the study.
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56 110 57 58 111 *Patient and public involvement*

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4 112 This research was done without patient involvement. Patients were not invited to
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6 113 comment on the study design and were not consulted to develop patient relevant
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9 114 outcomes or interpret the results. Patients were not invited to contribute to the writing
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11
12 115 or editing of this document for readability or accuracy.
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17 *Questionnaire*

18
19 118 Both questionnaires (Q1 and Q2) were pilot tested on a sample of 30 participants,
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21
22 119 and their feedback was used to further modify the items. The finalized instrument was
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25 120 administered electronically. The questionnaires used the precautionary measures
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28 121 promoted by the National Health Commission of the People's Republic of China on its
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30 122 official website as questions to determine the level of knowledge in influenza
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33 123 prevention. The survey consisted of two parts. The first part collected demographic
34
35 124 information on profession and gender while the second part asked about respondents'
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38 125 knowledge in influenza and the influenza vaccine, as well as attitude towards influenza
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40 126 vaccine—a set of questions with a Cronbach's alpha coefficient greater than 0.7.
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45 128 *Ethical approval*

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48 129 Our data collection procedures complied with the institutional and national ethical
49
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51 130 guidelines and followed the Declaration of Helsinki. The anonymity and confidentiality
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54 131 of data was maintained. Written informed consent was obtained from the investigators
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56 132 for this experiment. This study was approved by the Ethics Committee of Chongqing
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59 133 Medical University
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6 135 *Survey*

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9 136 We collated questions on influenza-related knowledge and influenza vaccine attitude
10
11 137 from both Q1 and Q2 and analyzed them after excluding redundant and repetitive
12
13 138 questions. Influenza-related knowledge was scored 1 point for a correct answer and 0
14
15 139 points for a wrong answer. The full score was 18 points and a score ≥ 11 would be
16
17 140 judged as knowing. Influenza vaccine knowledge rate (%) = number of correct
18
19 141 answers/total number of respondents $\times 100\%$. For influenza vaccine attitude, a score
20
21 142 was assigned according to the attitude towards influenza vaccine (5=very positive,
22
23 143 4=positive, 3=fair, 2=negative, 1=very negative). The full score was 25, any scores ≥ 15
24
25 144 would be considered as having a positive attitude towards influenza vaccine. Vaccine
26
27 145 vaccination rate (%) = number of influenzas vaccinated/total number of surveyed \times
28
29 146 100%. Influenza vaccination willingness rate (%) = number of people willing to receive
30
31 147 influenza vaccination/total number of people surveyed $\times 100\%$.

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42 14843 149 *Data analysis*

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45 150 Epidata 3.0 software was used for double data entry, and R 3.2.5 software was used
46
47 151 for statistical analysis; the differences between means were tested by T-test. The
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49 152 differences between rates were analyzed by chi-squared test, and unconditional logistic
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51 153 stepwise regression analysis was used for influencing factors of influenza vaccination
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53 154 intention. The level of statistical significance was chosen to be 0.05 ($\alpha = 0.05$).

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156 **Results**

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158 *Demographics*

159 A total of 803 medical students participated in the study between September and
160 October 2019. Only 484 medical students answered the questionnaire during the return
161 visit in November 2021. We define freshmen, sophomores and juniors as lower division
162 students, and Seniors and Fifth year students as the senior group. In the comparison
163 between 2021 and 2019, there are statistically significant differences in gross monthly
164 income(GMI), age and grade level, and the specific information can be seen in Table 1.

165

166 *Knowledge*

167 The knowledge rate of medical students about influenza and influenza vaccine was
168 82.8% in 2019 and 86% in 2021, and there was no statistically significant difference
169 between the two comparisons ($p=0.134$). The following six questions 1) “Wearing a
170 mask can prevent the spread of the flu to some extent”; 2) “Incubation period of
171 influenza”; 3) “Influenza can be spread through close contact with patient”; 4)
172 “Influenza vaccination for immunity is less costly and more cost-effective than
173 developing immunity from influenza infection”; 5) “The best time to get a flu
174 vaccination”; and 6) “How often should you get a flu vaccination?” are significantly
175 more known to the students in 2021 than in 2019. Meanwhile, these three questions 1)
176 “Influenza patients can spread the infection before symptoms appear”; 2) “Influenza
177 vaccination does not give you the flu although it carries live virus”; and 3) “What do

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4 178 you think the purpose of influenza vaccination is?" are less known to the students in
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6 179 2021 than in 2019 (Table 2.).
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11 181 *Attitudes*

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14 182 The percentage of medical students who were supportive of influenza vaccine was
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17 183 95.1% in 2019 and 97.1% in 2021, with no statistically significant difference between
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19
20 184 the two comparisons ($p=0.078$). As compared to the students' responses from 2019, a
21
22 185 higher percentage of medical students in 2021 believe that the influenza vaccine is
23
24 186 safe (91.5% > 65.1%); the influenza vaccination is necessary (83.9% > 67.0%); the
25
26 187 seasonal influenza vaccine is effective in preventing seasonal influenza (86.8% >
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28 188 73.2%); vaccination is important. However, we also observed a higher percentage of
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30 189 students in 2021 worried about the side effects of influenza vaccine relative to those
31
32 190 in 2019 (56.0% > 25.5%) (Table 3.).
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41 192 *Practices*

42
43 193 The main source of influenza vaccine information in 2019 was television,
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45 194 newspapers, and the media (48.6%), while the main source in 2021 was health care
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47 195 professionals (35.6%) (Figure 1).

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49
50 196 The number of people actively seeking information about influenza vaccine rose
51
52 197 from 183 (22.8%) in 2019 to 195 (40.3%) in 2021. The number of people who
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54 198 received influenza vaccination in 2021 was much higher than in 2019 (25.8% >
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56 199 6.7%), and the most significant increase in adverse reactions to vaccination was seen
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4 200 in the phenomenon of temporary mild pain, redness and swelling at the injection site
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6 201 (39.2% > 18.5%). Among the reasons for receiving influenza vaccination, both "To
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9 202 enhance resistance and prevent influenza" (88.8% > 75.9%) and "Recommended by
10
11 203 government and health authorities" (72.0 > 44.4%) were selected by a higher
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13
14 204 percentage of students in 2021 relative to 2019. (Table 4.).

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17 205 The three main reasons for not getting vaccinated in 2019 were "did not think it
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19 206 was necessary to get vaccinated" (53.8%), "did not know about the flu vaccine"
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22 207 (46.1%), and "did not have time " (41.1%). The three main reasons for not getting
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25 208 vaccinated in 2021 were: "didn't have time to get vaccinated" (43.5%), "didn't think it
26
27 209 was necessary to get vaccinated" (43.2%), and "didn't know about the flu vaccine"
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30 210 (35.9%) (Fig.2).

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32 211 During the COVID-19 epidemic in 2021, most students believed that the epidemic
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35 212 promoted awareness of influenza and influenza vaccine (96%) and willingness to
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38 213 receive influenza vaccination (74.8%) (Table 5.).

214 215 *Analysis of Single Factors Affecting Medical Students' Vaccination Intentions in 2021*

216 The vaccination rate of medical students who actively learned about influenza vaccine
217 was significantly higher than that of medical students who did not actively learn about
218 it (47.2% > 11.4%), and the vaccination rate of medical students who actively learned
219 about respiratory viral infectious diseases during COVID-19 was also higher than that
220 of medical students who did not actively learn about it (29.5% > 8.3%)(Table 6.).

221
222

222 Discussion

223 This study showed that the influenza vaccination rate of medical students in the
224 studied medical school was only 6.7% in the 2019 influenza season, which is lower
225 than the vaccination levels of medical students in other cities such as Urumqi, China
226 (9.2% in 2010) [9]. However, in 2021 the vaccination rate of medical students against
227 influenza rose to 25.8%, which is not as high as the vaccination level of medical
228 students in developed countries such as the United States and the United Kingdom, but
229 it is also a significant improvement as compared to 2019. This finding indicates that the
230 COVID-19 outbreak has significantly boosted the influenza vaccination rate of the
231 medical students that we studied. Similar results were obtained in a teaching and
232 research hospital in Milan, during the COVID-19 pandemic, flu vaccination rates for
233 physicians and administrative staff rise significantly[14]. This may be due to the fact
234 that there are numerous studies showing a significant reduction in the possibility of
235 contracting COVID-19 after receiving the flu vaccine, and therefore the willingness to
236 receive the flu vaccine has increased[15-16]

237 However, the level of influenza vaccination among medical students in Chongqing
238 is still low and needs to be further improved, and it is recommended that medical
239 students be included in the key recommended vaccination targets for influenza
240 vaccination.

241 Looking at the demographic characteristics of the students, the gross monthly
242 income(GMI) in 2021 is higher than that in 2019, which we speculate may be due to
243 inflation. Over time, the age and grade level in 2021 are higher than in 2019, which is

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4 244 also in line with the objective rule and our speculation.
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6 245 In terms of knowledge, there was no significant difference between the comparison
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9 246 of 2021 and 2019 ($p=0.134$). However, on average, only a quarter of the students knew
10
11 247 the incubation period time of influenza, and one similar study found that university
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13
14 248 education has a positive impact on influenza knowledge [17], indicating that students
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17 249 at this university do not pay much attention to influenza-related courses. The questions
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19 250 "Wearing a mask can prevent the spread of influenza to some extent," "Influenza can
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22 251 be spread through close contact with patients," and "Compared to developing immunity
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25 252 from influenza infection, getting immunity from influenza vaccination has better cost-
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28 253 effectiveness" are answered significantly more correctly in 2021 than in 2019. This is
29
30 254 because of the emergence of COVID-19, which is more widely known due to state and
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33 255 government campaigns and changes in daily lifestyle (e.g., the need to wear a mask
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36 256 when using public transportation). The question "side effects of influenza vaccination:
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39 257 fever, headache" was also better answered in 2021, probably due to the reactions that
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41
42 258 occurred during the vaccination with COVID-19 or the possible side effects told by
43
44
45 259 doctors or teachers before the vaccination [18-19]. As for the question "chronically ill
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47
48 260 and frail people are the priority recommended population for influenza vaccination",
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51 261 the answer was reversely better in 2019 than in 2021 ($87.8\% > 82.6\%$), which we
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54 262 speculate that this may be due to the fact that the COVID-19 vaccine is prohibited for
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57 263 patients with acute exacerbations of chronic disease or severe uncontrolled chronic
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60 264 disease in the Chinese New Crown Vaccination Technical Guidelines (Version 1), so
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266 some participants misunderstood that influenza vaccine is also contraindicated for

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4 266 patients with chronic disease, thus leading to a poor response to this question[20-23].
5

6 267 Regarding the comparison of attitudes towards influenza vaccine, although there was
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8
9 268 no significant difference between 2021 and 2019 ($p=0.078$), Students in 2021 were
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11 269 more likely to believe that influenza vaccine is safe and important, that vaccination
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14 270 against influenza is necessary, and that they are not concerned about the side effects of
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17 271 influenza vaccine. There are good reasons to attribute this to the COVID-19 epidemic
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19 272 The most important reason for influenza vaccination among medical students in both
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22 273 2021 and 2019 was "to increase resistance and prevent influenza", which is consistent
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25 274 with other studies [24-26], indicating that concerns for one's health are the driving
26
27
28 275 factor for influenza vaccination in this group. The reason "recommended by the
29
30 276 government and health authorities" increased from 44.4% in 2019 to 72% in 2021, this
31
32 277 is likely because of the government's strong call for people to get COVID-19 vaccine
33
34
35 278 in the past year, which led to the group's increased interest in influenza vaccination.
36

37 279 Among students who reported not receiving the influenza vaccine, the reasons for
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40 280 not receiving the vaccine in 2021 and 2019 are not very different, with a significant
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43 281 percentage of students not considering it necessary, suggesting that the influenza
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46 282 vaccine is not being taken seriously by this group. Among those who have not received
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48
49 283 the flu vaccine, the percentage of students who have "never heard of the flu vaccine"
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51 284 reached 46.1% in 2019 and 35.9% in 2021. It is recommended that health education on
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54 285 influenza and influenza vaccine be strengthened, such as holding a competition on
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56 286 influenza and influenza vaccine knowledge and providing specific training on influenza
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59 287 vaccination in degree programs. Vaccine safety was the least influential factor
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4 288 impeding vaccination, indicating solid expertise among study participants. The results
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6 289 of the present study suggest that providing more information increasing influenza
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9 290 vaccine awareness and basic knowledge of influenza vaccines among study participants
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12 291 may help improve vaccine coverage
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14 292 This study found that students with more knowledge in influenza vaccine were more
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16
17 293 inclined to receive influenza vaccine, which is consistent with previous studies [27].
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19 294 Students who took the initiative to learn about respiratory viral infectious diseases
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22 295 during COVID-19 transmission were also more likely to get the influenza vaccine,
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25 296 suggesting that the promotion and dissemination of knowledge about COVID-19 also
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28 297 helped people to understand more about influenza and influenza vaccine. This shows
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31 298 that in the current environment, we should attach knowledge about influenza to the
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34 299 promotion of COVID-19-related knowledge and prevention methods, so that people
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37 300 can receive COVID-19 vaccination and also pay attention to influenza vaccination,
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40 301 thereby increasing the influenza vaccination rate.
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43 303 *Limitations*

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45 304 This study has certain limitations. First, the data were collected via self-reported
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48 305 questionnaires, which can be a potential cause of reporting bias. Second, since our data
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51 306 were collected from medical students only, there is a possibility that they might have
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54 307 answered the questions positively on the basis of their medical knowledge as they had
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57 308 already perceived what would be expected from them. Third, the data were collected
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60 309 online through social networking platforms. Thus, we might have failed to approach

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4 310 the students who were not able to access internet, resulting in a sampling bias. Last,
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6 311 because our study was conducted at a medical school in Chongqing, China, it may limit
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9 312 the generalizability of the findings from this study. We will subsequently expand the
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12 313 sample source in hope of obtaining better results.
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315 **Conclusion**

316 The COVID-19 outbreak prompted an increase in influenza vaccination rates among
317 medical students in Chongqing (6.7% in 2019 to 25.8% in 2021), with almost all
318 students (96.0%) believing that the spread of COVID-19 promoted their knowledge of
319 influenza and influenza vaccine, and the vast majority (74.8%) believing that the spread
320 of COVID-19 promoted their willingness to receive influenza vaccine. We could
321 disseminate information about influenza vaccine along with information about covid-
322 19 vaccine to help increase influenza vaccination rates.
323

324 **Author Contributions**

325 YLW and XJT drafted the manuscript. GJW and XJT designed the
326 Questionnaire ;YLW and FZ collected the data; GJW, LG, QWL , YMJ and FZ
327 participated in data analysis and data extraction. YLW and XRW finalized the
328 manuscript. All authors read and approved the final manuscript.
329

330 **Acknowledgments**

331 The authors thank all participants of this study for sharing their time and experiences.
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333 **Funding**

334 This research received no external funding.

335

336 **Conflicts of Interest**

337 The authors declare no conflict of interest.

338

339 **Data availability statement**

340 Data are available upon reasonable request

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420 Table 1. Demographic characteristics of the study participants in Chongqing

Demographic information	2019 n(%)	2021 n(%)	Total	P
Gender				
Male	294 (36.6)	179 (37.0)	473	0.894
Female	509 (63.4)	305 (63.0)	814	
GMI				
<¥4000	507 (63.1)	275 (56.8)	782	0.025
≥¥4000	296 (36.9)	209 (43.2)	505	
Age				
18-20 years old	350 (43.6)	177 (36.6)	527	0.013
21-23 years old	453 (56.4)	307 (63.4)	760	
Grade Level				
Lower Division	167 (20.8)	39 (8.1)	206	<0.001
Senior group	636 (79.2)	445 (91.9)	1081	

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Table 2. Comparison of influenza vaccine knowledge in 2019 and 2021

Knowledge	Knowledge Awareness Level		P
	2019	2021	
	Awareness rate	Awareness rate	
	n (n/N*100%))	n (n/N*100%))	
Wearing a mask helps to prevent the spread of the flu	699 (87.0)	472 (97.5)	<0.001
Influenza is mainly spread by respiratory (coughing, sneezing) droplets	785 (97.8)	475 (98.1)	0.640
Incubation period of influenza	193 (24.0)	156 (32.2)	0.001
Influenza carriers (without symptoms) can spread the infection	706 (87.9)	391 (80.8)	0.001
Patients are contagious	525 (65.4)	439 (90.7)	<0.001

			1
The influenza shot			
contains live viruses	690 (85.9)	272 (56.2)	<0.00
cannot cause people to get			1
influenza.			
Influenza vaccination for			
immunity is less costly and			<0.00
more cost-effective than	373 (46.5)	420 (86.8)	1
developing immunity from			
influenza infection			
The best time to get			<0.00
vaccinated	412 (51.3)	310 (64.0)	1
Frequency of vaccination	297 (37.0)	213 (44.0)	0.013
Perception of the aim of			
flu vaccination	733 (91.3)	422 (87.2)	0.020
Side effects of influenza			
vaccination			
Fever	540 (67.2)	364 (75.2)	0.002
Pain and swelling at the			
injection site	672 (83.7)	419 (86.6)	0.160
Headaches			<0.00
	448 (55.8)	318 (65.7)	1

Influenza vaccination			
priority groups			
People over 60 years old	577 (71.9)	351 (72.5)	0.797
Patients with chronic illnesses and infirmity	705 (87.8)	400 (82.6)	0.011
Health facility staff, especially front-line staff	715 (89.0)	415 (85.7)	0.082
Pupils and kindergarten children	714 (88.9)	420 (86.8)	0.253
Pregnant women over the first trimester of pregnancy	360 (44.8)	192 (39.7)	0.069

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433 Table 3. Comparison of Influenza Vaccine Attitudes in 2019 vs. 2021

Attitude	2019		2021		P
	n	% (n/N)	n	% (n/N)	
Flu vaccine is safe					
Agree	523	65.1	443	91.5	<0.001
Disagree	280	34.9	41	8.5	
Flu vaccination is necessary					

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4	Agree	538	67.0	406	83.9	
5						
6	Disagree	265	33.0	78	16.1	<0.001
7						
8						
9	You are not worried about the side effects					
10	of the flu vaccine					
11						
12	Agree	205	25.5	271	56.0	
13						
14	Disagree	598	74.5	213	44.0	<0.001
15						
16	The seasonal flu vaccine is more effective					
17	in preventing seasonal flu					
18						
19	Agree	588	73.2	420	86.8	
20						
21	Disagree	215	26.8	64	13.2	<0.001
22						
23	Annual flu vaccination is important for					
24	you					
25						
26	Agree	346	43.1	287	59.3	
27						
28	Disagree	457	56.9	197	40.7	<0.001
29						
30	You are planning to get a flu vaccination					
31	this autumn/winter					
32						
33	Agree	268	33.4	187	38.6	
34						
35	Disagree	535	66.6	297	61.4	0.056
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53	435	Table 4. Comparison of influenza vaccination behaviour in 2019 vs.2021				
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4	Do you take the initiative to learn					
5						
6	about the flu vaccine?					
7						
8						
9	Yes	183	22.8	195	40.3	
10						
11						<0.001
12	No	620	77.2	289	59.7	
13						
14	Did you get a flu vaccination last					
15						
16	year?					
17						
18						
19	Yes	54	6.7	125	25.8	
20						
21						<0.001
22	No	749	93.3	359	74.2	
23						
24						
25	Did you have any of the following					
26						
27	adverse reactions in your last flu					
28						
29	vaccination?					
30						
31						
32	Severe allergic reactions	7	13.0	23	18.4	0.362
33						
34	Dizziness	9	16.7	26	20.8	0.483
35						
36	Low fever	7	13.0	23	18.4	0.337
37						
38	Transient mild pain, redness and					
39						
40	swelling at the injection site	10	18.5	49	39.2	0.004
41						
42	No adverse reactions	36	66.7	67	53.6	0.136
43						
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47						
48	What are your reasons for getting the					
49						
50	flu vaccine?					
51						
52						
53	Build up your resistance and					
54						
55	prevent flu	41	75.9	111	88.8	0.033
56						
57						
58	Recommendation from government	24	44.4	90	72.0	<0.001
59						
60						

and health authorities					
Recommended by family and	17	31.5	58	46.4	0.061
friends					
Other	3	5.6	1	0.8	0.061
Have you had a flu-like illness within					
1 year of vaccination?					
Yes	8	14.8	17	13.6	
No	25	46.3	96	76.8	<0.001
Don't remember	21	38.9	12	9.6	

436

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Table 5. Analysis of COVID-19 related behaviors in 2021 (frequency statistics)

COVID-19 Related Acts	Number of people	Percentage (%)
The COVID-19 outbreak promotes your learning about respiratory infectious diseases		
Yes	400	82.6
No	84	17.4
The COVID-19 outbreak raised your awareness of flu and flu vaccine.		
Yes	384	96.0
No	16	4.0
The COVID-19 Outbreak boosts your intention to get flu		

vaccinated.

Yes	362	74.8
No	122	25.2

438

439 Table 6. Analysis of factors influencing medical students' willingness to receive
440 vaccinations in 2021.

Variables	Number of people vaccinated (percentage%)	Number of unvaccinated persons (%)	OR value (95% CI)	P
Gender				
Male	49(27.4)	130(72.6)	1.136(0.747-1.726)	0.551
Female	76(24.9)	229(75.1)	Ref	
Age				
18-20	48(27.1)	129(72.9)	1.111(.7300-1.692)	0.622
21-23	77(25.1)	230(74.9)	Ref	
Grade Level				
Lower School	14(35.9)	25(64.1)	1.685(0.846-3.355)	0.137
Upper School	111(24.9)	334(75.1)	Ref	
GMI				

	<¥4000	65(23.6)	210(76.4)	0.769(0.511-1.157)	
	≥¥4000	60(28.7)	149(71.3)	Ref	0.207
Attitudes towards the flu vaccine					
	Negative	1(7.1)	13(92.9)	Ref	
	Active	124(26.4)	346(73.6)	4.659(0.603-35.984)	0.140
Level of knowledge					
	Understanding	13(19.1)	55(80.9)	Ref	
	Don't understand	112(26.9)	304(84.7)	1.559(0.820-2.962)	0.443
proactive about information about flu vaccines					
	Yes	92(47.2)	103(52.8)	6.929(4.380-10.963)	
	No	33(11.4)	256(88.6)	Ref	<0.001
learning about respiratory infectious diseases during the COVID-19 outbreak					
	Yes	118(29.5)	282(70.5)	4.603(2.062-10.275)	
	No	7(8.3)	77(91.7)	Ref	<0.001

Fig.1 Sources of Influenza Vaccine Information for 2019 vs. 2021

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Fig. 2 Main reasons for not getting an influenza vaccination in 2019 vs. 2021

For peer review only

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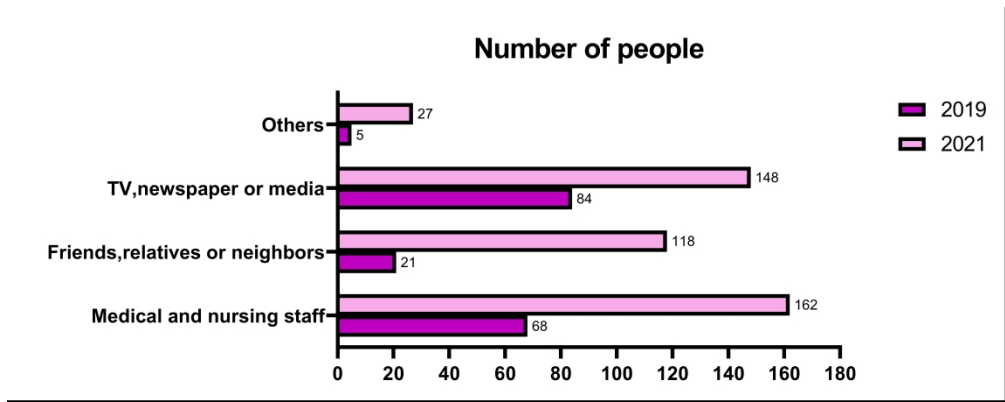
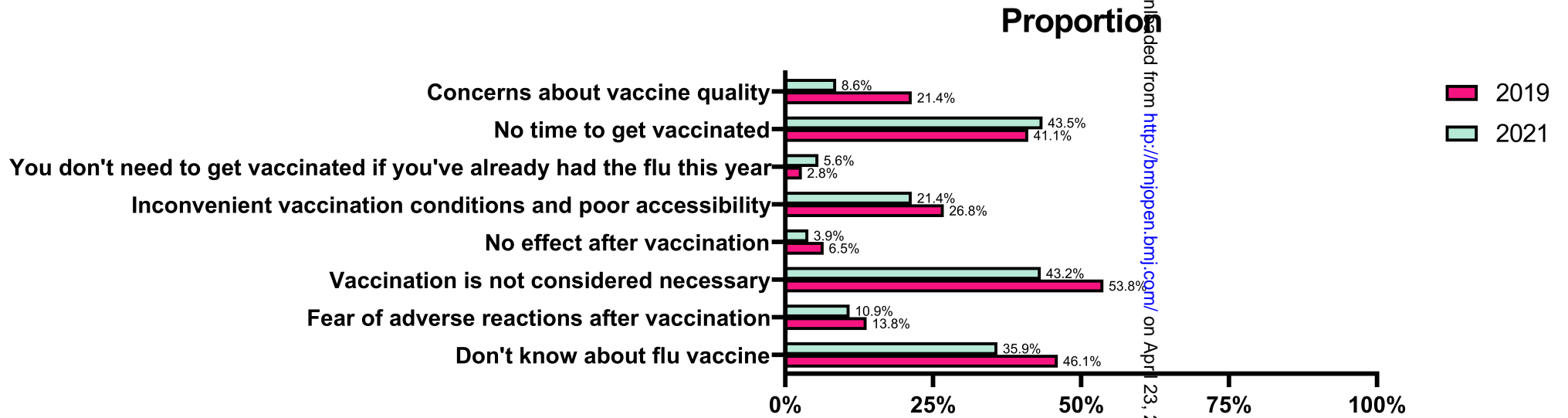


Fig. 1 Sources of Influenza Vaccine Information for 2019 vs. 2021

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STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1-2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5-6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7
Bias	9	Describe any efforts to address potential sources of bias	7
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5-6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7
		(b) Describe any methods used to examine subgroups and interactions	7
		(c) Explain how missing data were addressed	
		(d) If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	7
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8-9
		(b) Give reasons for non-participation at each stage	8-9
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8-9
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	8-17
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-17

		(b) Report category boundaries when continuous variables were categorized	8-17
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	8-17
Discussion			
Key results	18	Summarise key results with reference to study objectives	19-21
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	22-23
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	23
Generalisability	21	Discuss the generalisability (external validity) of the study results	21-23
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	24

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Does COVID-19 have an impact on influenza vaccine knowledge, attitude and practice among medical students: a two-year Prospective cohort study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-055945.R3
Article Type:	Original research
Date Submitted by the Author:	04-Jul-2022
Complete List of Authors:	Wang, Yunlong; Chongqing Medical University Wu, Guangjie; Chongqing Medical University, School of Public Health and Management Jiang, Yueming; Chongqing Medical University, Clinical 5+3 integration, the second clinical school Zou, Fa; Chongqing Medical University Gan, Lin; Chongqing Medical University Luo, Qinwen; Chongqing Medical University Tang, Xiaojun; Chongqing Medical University Wu, Xiaorong; Chongqing Medical University
Primary Subject Heading:	Epidemiology
Secondary Subject Heading:	Public health
Keywords:	Epidemiology < INFECTIOUS DISEASES, Public health < INFECTIOUS DISEASES, IMMUNOLOGY, COVID-19

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6 2 **Does COVID-19 have an impact on influenza vaccine**
7 **knowledge, attitude and practice among medical students: a**
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9 3 **two-year Prospective cohort study**
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67 **ABSTRACT**

8
9 26 *Objectives* To explore the main factors affecting the knowledge, attitude and
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11 27 practice about influenza and influenza vaccine as well as the intention to receive
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14 28 influenza vaccination among the same group of medical students before (2019) and
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17 29 after (2021) the COVID-19 outbreak.

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19 30 *Design* A population-based prospective cohort study.

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22 31 *Setting* A longitudinal cohort study of a selected medical school in Chongqing,
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25 32 China, which ran from 2019 to 2021.

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27 33 *Participants* A total of 803 medical students participated in the study in 2019 and
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29 34 only 484 students responded in 2021. The response rate for our survey was only 60.27%
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31 35 due to graduation, emails being abandoned, etc.

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34 36 *Results* The influenza vaccination rate of students at this medical school was 6.7% in
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37 37 2019, compared with 25.8% in 2021. The awareness rate of medical students about
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40 38 influenza and influenza vaccine was 82.8% in 2019 and 86% in 2021, and there was no
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43 39 significantly statistical difference between the two years ($p = 0.134$); the number of
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46 40 medical students with supportive attitude towards influenza vaccine was 95.1% in 2019
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49 41 and 97.1% in 2021, and there was no statistically significant difference between the two
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52 42 years ($p = 0.078$); the number of students who actively learned about knowledge related
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54
55 43 to influenza vaccine rose from 183 (22.8%) in 2019 to 195 (40.3%) in 2021.

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57 44 *Conclusions* The COVID-19 outbreak prompted an increase in influenza vaccination
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59 45 rates among medical students in Chongqing, with almost all students (96.0%) believing
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4 46 that the spread of COVID-19 promoted their knowledge in influenza and influenza
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6 47 vaccine, and the vast majority (74.8%) believing that the spread of COVID-19
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9 48 promoted their willingness to receive influenza vaccine.
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11 49 *Key words* Education, Flu, Immunization, Vaccine, Infection, COVID-19
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17 51 **Strengths and limitations of this study**

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19 52 ·Comparing knowledge attitude and practice toward influenza vaccine in the same
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22 53 group before and after the COVID-19 outbreak, and this condition cannot be replicated
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25 54 now.

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27 55 ·This study will contribute to the promotion of influenza vaccination in the medical
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30 56 student population.

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32 57 ·The data were collected online through social networking platforms. Thus, we might
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35 58 have failed to approach the students who were not able to access internet, resulting in a
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38 59 sampling bias.

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40 60 ·Because our study was conducted at a medical school in Chongqing, it may limit the
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43 61 generalizability of the study.
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48 63 **Background**

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50 64 Influenza (or flu), a respiratory tract infectious disease, is extremely contagious.
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53 65 Influenza virus antigenicity is variable and spreads rapidly.This virus can cause
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56 66 seasonal epidemics each year.[1]. China's Influenza Treatment Program (2020 version)
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59 67 clearly states that "annual influenza vaccination is the most effective means for
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4 68 influenza prevention, reducing the risk of influenza and serious complications in
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6 69 vaccinated individuals"[2].During the outbreak of pandemic Coronavirus disease 2019
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9 70 (COVID-19), the Chinese Ministry of Health considers influenza vaccination for 2020-
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11 71 2021 to be particularly important[3]. Influenza vaccination has become especially
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14 72 important as the severe global epidemic of COVID-19 will continue this year and there
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17 73 may be a superimposed epidemic of COVID-19 along with influenza and other
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20 74 respiratory infectious diseases this winter and next spring.

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22 75 As a place where students frequently gather, the relatively crowded learning and
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25 76 living environment of schools makes it easy for students to catch the flu, and college
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28 77 students are highly mobile between campuses. Surveillance data from several provinces
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31 78 in recent years has shown that more than 90% of influenza each year occurs on
32
33 79 campus.From 2004-2008, 90.48% of influenza outbreaks in Jiangsu Province occurred
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35 80 on campus.From 2006-2013, 97.26% of influenza outbreaks in Shanxi Province also
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38 81 occurred on campus[4-6]. Among all the students on campus, medical students are
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41 82 believed to possess a higher risk of influenza illness than other students due to the
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44 83 specificity of their discipline. They are the future medical workers and important
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46 84 disseminators of health knowledge, so there is a need for vaccination for them[7].

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48 85 However, few has been reported regarding the current status of influenza vaccination
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51 86 in this group in China. From the few studies, it was found that the current vaccination
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54 87 rate of medical students in China was much lower than that of foreign countries.
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56 88 Influenza vaccination rates for medical students were 17.1% in northwest China, 25.3%
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58 89 in Brazil, 20.7% in Saudi Arabia, 53.8% in Australia, 76% in the United Kingdom, and
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4 90 43% in the United States[4,8-13]. To explore whether medical students'
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7 91 knowledge,attitude and practice about influenza and influenza vaccine have changed
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10 92 under the influence of today's COVID-19 epidemic, we compared the results of a survey
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12 93 on their knowledge and attitude about influenza and influenza vaccine among the same
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14 94 group of medical students before the outbreak (2019) and after the outbreak (2021) to
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17 95 1) investigate the main factors affecting medical students' willingness to receive
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19 96 influenza vaccination; 2) provide a scientific basis for improving influenza vaccination
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22 97 rates among medical students and strengthening influenza prevention and control
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25 98 efforts in the current context.
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100 **MATERIAL AND METHODS**

101 102 *Study design and settings*

103 In this prospective cohort study, a survey study focusing on influenza and influenza
104 vaccine awareness and willingness to vaccinate was first conducted among freshman-
105 year to senior-year medical students in a medical school in Chongqing, China from
106 September 2019 to October 2019, and the questionnaire applied was named Q1. A new
107 survey on influenza and influenza vaccine knowledge, attitude and practice to vaccinate
108 with some slight modifications due to the COVID-19 was sent by email to volunteers
109 who had previously received the questionnaire (Q1) in November 2021, and the new
110 questionnaire was named Q2. The questionnaire data was compiled and collected in
111 January 2022.The final return rate of the questionnaire was only 60.27% due to
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4 112 graduation, email discontinuation, etc. All participants in 2019 were randomly selected
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6 113 and volunteered to participate in this experiment and were not involved in the conduct
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9 114 of the study.
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13 14 116 *Patient and public involvement*

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17 117 This research was done without patient involvement. Patients were not invited to
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19 118 comment on the study design and were not consulted to develop patient relevant
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21 119 outcomes or interpret the results. Patients were not invited to contribute to the writing
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23 120 or editing of this document for readability or accuracy.
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28 29 30 122 *Questionnaire*

31
32 123 Both questionnaires (Q1 and Q2) were pilot tested on a sample of 30 participants,
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34 124 and their feedback was used to further modify the items. The finalized instrument was
35
36 125 administered electronically. The questionnaires used the precautionary measures
37
38 126 promoted by the National Health Commission of the People's Republic of China on its
39
40 127 official website as questions to determine the level of knowledge in influenza
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42 128 prevention. The survey consisted of two parts. The first part collected demographic
43
44 129 information on profession and gender while the second part asked about respondents'
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46 130 knowledge in influenza and the influenza vaccine, as well as attitude towards influenza
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48 131 vaccine—a set of questions with a Cronbach's alpha coefficient greater than 0.7.
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57 58 133 *Ethical approval*

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4 134 Our data collection procedures complied with the institutional and national ethical
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6 135 guidelines and followed the Declaration of Helsinki. The anonymity and confidentiality
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9 136 of data was maintained. Written informed consent was obtained from the investigators
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11 137 for this experiment. This study was approved by the Ethics Committee of Chongqing
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14 138 Medical University

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18 19 140 *Survey*

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22 141 We collated questions on influenza-related knowledge and influenza vaccine attitude
23
24 142 from both Q1 and Q2 and analyzed them after excluding redundant and repetitive
25
26
27 143 questions. Influenza-related knowledge was scored 1 point for a correct answer and 0
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30 144 point for a wrong answer. The full score was 18 points and a score ≥ 11 would be
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33 145 judged as knowing. Influenza vaccine knowledge rate (%) = number of correct
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35 146 answers/total number of respondents $\times 100\%$. For influenza vaccine attitude, a score
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38 147 was assigned according to the attitude towards influenza vaccine (5=very positive,
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40 148 4=positive, 3=fair, 2=negative, 1=very negative). The full score was 25, any scores ≥ 15
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43 149 would be considered as having a positive attitude towards influenza vaccine. Vaccine
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45 150 vaccination rate (%) = number of influenzas vaccinated/total number of surveyed \times
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48 151 100%. Influenza vaccination willingness rate (%) = number of people willing to receive
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51 152 influenza vaccination/total number of people surveyed $\times 100\%$.

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54 55 154 *Data analysis*

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58 155 Epidata 3.0 software was used for double data entry, and spss24.0 software was used
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4 156 for statistical analysis. The differences between rates were analyzed by chi-squared test,
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6 157 and unconditional logistic stepwise regression analysis was used for influencing factors
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9 158 of influenza vaccination intention. The level of statistical significance was chosen to be
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12 159 0.05 ($\alpha = 0.05$).
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17 161 **Results**

18 19 20 162 21 22 163 *Demographics*

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25 164 A total of 803 medical students participated in the study between September and
26
27 165 October 2019. Only 484 medical students answered the questionnaire during the return
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30 166 visit in November 2021. We define freshmen, sophomores and juniors as lower division
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32 167 students, and Seniors and Fifth year students as the senior group. In the comparison
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34
35 168 between 2021 and 2019, there are statistically significant differences in gross monthly
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37 169 income(GMI), age and grade level, and the specific information can be seen in Table 1.
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43 171 *Knowledge*

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45 172 The knowledge rate of medical students about influenza and influenza vaccine was
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48 173 82.8% in 2019 and 86% in 2021, and there was no statistically significant difference
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51 174 between the two comparisons ($p=0.134$). The following six questions 1) “Wearing a
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53 175 mask can prevent the spread of the flu to some extent”; 2) “Incubation period of
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56 176 influenza”; 3) “Influenza can be spread through close contact with patient”; 4)
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58 177 “Influenza vaccination for immunity is less costly and more cost-effective than
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4 178 developing immunity from influenza infection”; 5) “The best time to get a flu
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6 179 vaccination”; and 6) “How often should you get a flu vaccination?” are significantly
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9 180 more known to the students in 2021 than in 2019. Meanwhile, these three questions 1)
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11 181 “Influenza patients can spread the infection before symptoms appear”; 2) “Influenza
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13 182 vaccination does not give you the flu although it carries live virus”; and 3) “What do
14
15 183 you think the purpose of influenza vaccination is?” are less known to the students in
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19 184 2021 than in 2019 (Table 2.).
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186 *Attitudes*

187 The percentage of medical students who were supportive of influenza vaccine was
188 95.1% in 2019 and 97.1% in 2021, with no statistically significant difference between
189 the two comparisons ($p=0.078$). As compared to the students’ responses from 2019, a
190 higher percentage of medical students in 2021 believe that the influenza vaccine is
191 safe (91.5% > 65.1%); the influenza vaccination is necessary (83.9% > 67.0%); the
192 seasonal influenza vaccine is effective in preventing seasonal influenza (86.8% >
193 73.2%); vaccination is important. However, we also observed a higher percentage of
194 students in 2021 worried about the side impacts of influenza vaccine relative to those
195 in 2019 (56.0% > 25.5%) (Table 3.).
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197 *Practices*

198 The main source of influenza vaccine information in 2019 was television,
199 newspapers, and the media (48.6%), while the main source in 2021 was health care
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4 200 professionals (35.6%) (Figure 1).
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6 201 The number of people actively seeking information about influenza vaccine rose
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9 202 from 183 (22.8%) in 2019 to 195 (40.3%) in 2021. The number of people who
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11 203 received influenza vaccination in 2021 was much higher than in 2019 (25.8% >
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13
14 204 6.7%), and the most significant increase in adverse reactions to vaccination was seen
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16
17 205 in the phenomenon of temporary mild pain, redness and swelling at the injection site
18
19 206 (39.2% > 18.5%). Among the reasons for receiving influenza vaccination, both "To
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21 207 enhance resistance and prevent influenza" (88.8% > 75.9%) and "Recommended by
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23 208 government and health authorities" (72.0% > 44.4%) were selected by a higher
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27 209 percentage of students in 2021 relative to 2019. (Table 4.).
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30 210 The three main reasons for not getting vaccinated in 2019 were "did not think it
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32 211 was necessary to get vaccinated" (53.8%), "did not know about the flu vaccine"
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34 212 (46.1%), and "did not have time " (41.1%). The three main reasons for not getting
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37 213 vaccinated in 2021 were: "didn't have time to get vaccinated" (43.5%), "didn't think it
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39 214 was necessary to get vaccinated" (43.2%), and "didn't know about the flu vaccine"
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41 215 (35.9%) (Fig.2).
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45 216 During the COVID-19 epidemic in 2021, most students believed that the epidemic
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47 217 promoted awareness of influenza and influenza vaccine (96%) and willingness to
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49 218 receive influenza vaccination (74.8%) (Table 5.).
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56 220 *Analysis of Single Factors Affecting Medical Students' Vaccination Intentions in 2021*
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58 221 The vaccination rate of medical students who actively learned about influenza vaccine
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4 222 was significantly higher than that of medical students who did not actively learn about
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6 223 it (47.2% > 11.4%), and the vaccination rate of medical students who actively learned
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9 224 about respiratory viral infectious diseases during COVID-19 was also higher than that
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12 225 of medical students who did not actively learn about it (29.5% > 8.3%)(Table 6.).
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17 227 **Discussion**

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19 228 This study showed that the influenza vaccination rate of medical students in the
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21
22 229 studied medical school was only 6.7% in the 2019 influenza season, which is lower
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24
25 230 than the vaccination levels of medical students in other cities such as Urumqi, China
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27 231 (9.2% in 2010) [9]. In 2021 the vaccination rate of medical students against influenza
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30 232 rose to 25.8%, which was not as high as the vaccination level of medical students in
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33 233 developed countries such as the United States and the United Kingdom, but it is also a
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35 234 significant improvement as compared to 2019. This finding indicates that the COVID-
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38 235 19 outbreak has significantly boosted the influenza vaccination rate of the medical
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41 236 students that we studied. Similar results were obtained in a teaching and research
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44 237 hospital in Milan, during the COVID-19 pandemic, and flu vaccination rates for
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46 238 physicians and administrative staff rise significantly[14].This may be due to the fact
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49 239 that there are numerous studies showing a significant reduction in the possibility of
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52 240 contracting COVID-19 after receiving the flu vaccine, therefore, the willingness to
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55 241 receive the flu vaccine has increased[15-16]

56 242 However, the level of influenza vaccination among medical students in Chongqing
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59 243 is still low and needs to be further improved, and it is recommended that medical
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4 244 students be included in the key recommended vaccination targets for influenza
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6 245 vaccination.
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9 246 Looking at the demographic characteristics of the students, the gross monthly
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11 247 income(GMI) in 2021 is higher than that in 2019, which our speculation may be due to
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14 248 inflation. Over time, the age and grade level in 2021 are higher than in 2019, which is
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17 249 also in line with the objective rule and our speculation.
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19 250 In terms of knowledge, there was no significant difference between the comparison
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22 251 of 2021 and 2019 ($p=0.134$). However, on average, only a quarter of the students knew
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25 252 the incubation period time of influenza, and one similar study found that university
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28 253 education has a positive impact on influenza knowledge [17], indicating that students
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31 254 at this university do not pay much attention to influenza-related courses. The questions
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33 255 "Wearing a mask can prevent the spread of influenza to some extent," "Influenza can
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35 256 be spread through close contact with patients," and "Compared to developing immunity
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38 257 from influenza infection, getting immunity from influenza vaccination has better cost-
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41 258 effectiveness" are answered significantly more correctly in 2021 than in 2019. This is
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43 259 because of the emergence of COVID-19, which is more widely known due to state and
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46 260 government campaigns and changes in daily lifestyle (e.g., the need to wear a mask
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49 261 when using public transportation). The question "side impacts of influenza vaccination:
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51 262 fever, headache" was also better answered in 2021, probably due to the reactions that
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54 263 occurred during the vaccination with COVID-19 or the possible side impacts told by
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57 264 doctors or teachers before the vaccination [18-19]. As for the question "chronically ill
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59 265 and frail people are the priority recommended population for influenza vaccination",
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4 266 the answer was reversely better in 2019 than in 2021 (87.8% > 82.6%), which we
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6 267 speculate that this may be due to the fact that the COVID-19 vaccine is prohibited for
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9 268 patients with acute exacerbations of chronic disease or severe uncontrolled chronic
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11 269 disease in the Chinese New Crown Vaccination Technical Guidelines (Version 1), so
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14 270 some participants misunderstood that influenza vaccine is also contraindicated for
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17 271 patients with chronic disease, thus leading to a poor response to this question[20-23].

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19 272 Regarding the comparison of attitudes towards influenza vaccine, although there was
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21
22 273 no significant difference between 2021 and 2019 ($p=0.078$), Students in 2021 were
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25 274 more likely to believe that influenza vaccine is safe and important, that vaccination
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28 275 against influenza is necessary, and that they are not concerned about the side impacts
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30 276 of influenza vaccine. There are good reasons to attribute this to the COVID-19 epidemic

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32 277 The most important reason for influenza vaccination among medical students in both
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34
35 278 2021 and 2019 was "to increase resistance and prevent influenza", which is consistent
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38 279 with other studies [24-26], indicating that concerns for one's health are the driving
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41 280 factor for influenza vaccination in this group. The reason "recommended by the
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43 281 government and health authorities" increased from 44.4% in 2019 to 72% in 2021, this
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45
46 282 is likely because of the government's strong call for people to get COVID-19 vaccine
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48 283 in the past year, which led to the group's increased interest in influenza vaccination.

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50 284 Among students who reported not receiving the influenza vaccine, the reasons for
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52
53 285 not receiving the vaccine in 2021 and 2019 are not very different, with a significant
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56 286 percentage of students not considering it necessary, suggesting that the influenza
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58 287 vaccine is not being taken seriously by this group. Among those who have not received
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4 288 the flu vaccine, the percentage of students who have "never heard of the flu vaccine"
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6 289 reached 46.1% in 2019 and 35.9% in 2021. It is recommended that health education on
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9 290 influenza and influenza vaccine should be strengthened, such as holding a competition
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11 291 on influenza and influenza vaccine knowledge and providing specific training on
12
13
14 292 influenza vaccination in degree programs. Vaccine safety was the least influential factor
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17 293 impeding vaccination, indicating solid expertise among study participants. The results
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19 294 of the present study suggest that providing more information increasing influenza
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22 295 vaccine awareness and basic knowledge of influenza vaccines among study participants
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25 296 may help improve vaccine coverage

26
27 297 This study found that students with more knowledge in influenza vaccine were more
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29
30 298 inclined to receive influenza vaccine, which is consistent with previous studies [27].
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32
33 299 Students who took the initiative to learn about respiratory viral infectious diseases
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35 300 during COVID-19 transmission were also more likely to get the influenza vaccine,
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37
38 301 suggesting that the promotion and dissemination of knowledge about COVID-19 also
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40
41 302 helped people to understand more about influenza and influenza vaccine. This shows
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43 303 that in the current environment, we should attach knowledge about influenza to the
44
45 304 promotion of COVID-19-related knowledge and prevention methods, so that people
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48 305 can receive COVID-19 vaccination and also pay attention to influenza vaccination,
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51 306 thereby increasing the influenza vaccination rate.

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54 55 56 308 *Limitations*

57
58 309 This study has certain limitations. First, the data were collected via self-reported
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4 310 questionnaires, which can be a potential cause of reporting bias. Second, since our data
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6 311 were collected from medical students only, there is a possibility that they might have
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9 312 answered the questions positively on the basis of their medical knowledge as they had
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11 313 already perceived what would be expected from them. Third, the data were collected
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14 314 online through social networking platforms. Thus, we might have failed to approach
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17 315 the students who were not able to access internet, resulting in a sampling bias. Last,
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19 316 because our study was conducted at a medical school in Chongqing, China, it may limit
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21
22 317 the generalizability of the findings from this study. We will subsequently expand the
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25 318 sample source in hope of obtaining better results.
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320 **Conclusion**

321 The COVID-19 outbreak prompted an increase in influenza vaccination rates among
322 medical students in Chongqing (6.7% in 2019 to 25.8% in 2021), with almost all
323 students (96.0%) believing that the spread of COVID-19 promoted their knowledge of
324 influenza and influenza vaccine, and the vast majority (74.8%) believing that the spread
325 of COVID-19 promoted their willingness to receive influenza vaccine. We could
326 disseminate information about influenza vaccine along with information about covid-
327 19 vaccine to help increase influenza vaccination rates.
328

329 **Author Contributions**

330 YLW and XJT drafted the manuscript. GJW and XJT designed the
331 Questionnaire ;YLW and FZ collected the data; GJW, LG, QWL , YMJ and FZ

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4 332 participated in data analysis and data extraction. YLW and XRW finalized the
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6 333 manuscript. All authors read and approved the final manuscript.
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9 334

11 335 **Acknowledgments**

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14 336 The authors thank all participants of this study for sharing their time and experiences.
15
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17 337

19 338 **Funding**

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22 339 This research received no external funding.
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27 341 **Conflicts of Interest**

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29
30 342 The authors declare no conflict of interest.
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35 344 **Data availability statement**

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37 345 Data are available upon reasonable request
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40 346 **Ethics approval and consent to participate**

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42
43 347 This two-year prospective cohort study was approved by the Ethics Committee of
44
45 348 Chongqing Medical University. Participation in this study was voluntary, and informed
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48 349 consent was gained. Our data collection procedures complied with the institutional and
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51 350 national ethical guidelines and followed the Declaration of Helsinki. The anonymity
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53 351 and confidentiality of data was maintained. Written informed consent was obtained
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56 352 from the investigators for this experiment.
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432 Table 1. Demographic characteristics of the study participants in Chongqing

	2019	2021	Total	P
Demographic information	n(%)	n(%)		

Gender				
Male	294 (36.6)	179 (37.0)	473	0.894
Female	509 (63.4)	305 (63.0)	814	
GMI				
<¥4000	507 (63.1)	275 (56.8)	782	0.025
≥¥4000	296 (36.9)	209 (43.2)	505	
Age				
18-20 years old	350 (43.6)	177 (36.6)	527	0.013
21-23 years old	453 (56.4)	307 (63.4)	760	
Grade Level				
Lower Division	167 (20.8)	39 (8.1)	206	<0.001
Senior group	636 (79.2)	445 (91.9)	1081	

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Table 2. Comparison of influenza vaccine knowledge in 2019 and 2021

Knowledge	Knowledge Awareness Level		P
	2019	2021	
	Awareness rate	Awareness rate	
	n	n	
	(n/N*100%)	(n/N*100%)	
Wearing a mask helps to	699 (87.0)	472 (97.5)	<0.001

1				
2				
3				
4	prevent the spread of the			
5				
6	flu			
7				
8				
9	Influenza is mainly			
10				
11	spread by respiratory			
12		785 (97.8)	475 (98.1)	0.640
13	(coughing, sneezing)			
14				
15	droplets			
16				
17	Incubation period of			
18		193 (24.0)	156 (32.2)	0.001
19	influenza			
20				
21	Influenza carriers			
22				
23	(without symptoms) can	706 (87.9)	391 (80.8)	0.001
24				
25	spread the infection			
26				
27	Patients are contagious	525 (65.4)	439 (90.7)	<0.001
28				
29	The influenza shot			
30				
31	contains live viruses			
32		690 (85.9)	272 (56.2)	<0.001
33	cannot cause people to			
34				
35	get influenza.			
36				
37	Influenza vaccination for			
38				
39	immunity is less costly			
40				
41	and more cost-effective			
42		373 (46.5)	420 (86.8)	<0.001
43	than developing			
44				
45	immunity from influenza			
46				
47	infection			

The best time to get vaccinated	412 (51.3)	310 (64.0)	<0.001
Frequency of vaccination	297 (37.0)	213 (44.0)	0.013
Perception of the aim of flu vaccination	733 (91.3)	422 (87.2)	0.020
Side effects of influenza vaccination			
Fever	540 (67.2)	364 (75.2)	0.002
Pain and swelling at the injection site	672 (83.7)	419 (86.6)	0.160
Headaches	448 (55.8)	318 (65.7)	<0.001
Influenza vaccination priority groups			
People over 60 years old	577 (71.9)	351 (72.5)	0.797
Patients with chronic illnesses and infirmity	705 (87.8)	400 (82.6)	0.011
Health facility staff, especially front-line staff	715 (89.0)	415 (85.7)	0.082
Pupils and kindergarten children	714 (88.9)	420 (86.8)	0.253
Pregnant women over the	360 (44.8)	192 (39.7)	0.069

first trimester of
pregnancy

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Table 3. Comparison of Influenza Vaccine Attitudes in 2019 vs. 2021

Attitude	2019		2021		P
	n	% (n/N)	n	% (n/N)	
Flu vaccine is safe					
Agree	523	65.1	443	91.5	<0.001
Disagree	280	34.9	41	8.5	
Flu vaccination is necessary					
Agree	538	67.0	406	83.9	<0.001
Disagree	265	33.0	78	16.1	
You are not worried about the side effects of the flu vaccine					
Agree	205	25.5	271	56.0	<0.001
Disagree	598	74.5	213	44.0	
The seasonal flu vaccine is more effective in preventing seasonal flu					
Agree	588	73.2	420	86.8	<0.001

Disagree	215	26.8	64	13.2	
Annual flu vaccination is important for you					
Agree	346	43.1	287	59.3	<0.001
Disagree	457	56.9	197	40.7	
You are planning to get a flu vaccination this autumn/winter					
Agree	268	33.4	187	38.6	0.056
Disagree	535	66.6	297	61.4	

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Table 4. Comparison of influenza vaccination behaviour in 2019 vs.2021

Behaviour	2019		2021		P
	n	%(n/N)	n	%(n/N)	
Do you take the initiative to learn about the flu vaccine?					
Yes	183	22.8	195	40.3	<0.001
No	620	77.2	289	59.7	
Did you get a flu vaccination last year?					
Yes	54	6.7	125	25.8	<0.001
No	749	93.3	359	74.2	
Did you have any of the following					

adverse reactions in your last flu

vaccination?

Severe allergic reactions 7 13.0 23 18.4 0.362

Dizziness 9 16.7 26 20.8 0.483

Low fever 7 13.0 23 18.4 0.337

Transient mild pain, redness and swelling at the injection site 10 18.5 49 39.2 0.004

No adverse reactions 36 66.7 67 53.6 0.136

What are your reasons for getting the flu vaccine?

Build up your resistance and prevent flu 41 75.9 111 88.8 0.033

Recommendation from government and health authorities 24 44.4 90 72.0 <0.001

Recommended by family and friends 17 31.5 58 46.4 0.061

Other 3 5.6 1 0.8 0.061

Have you had a flu-like illness within

1 year of vaccination?

Yes 8 14.8 17 13.6

No 25 46.3 96 76.8 <0.001

Don't remember 21 38.9 12 9.6

448

449 Table 5. Analysis of COVID-19 related behaviors in 2021 (frequency statistics)

COVID-19 Related Acts	Number of people	Percentage (%)
The COVID-19 outbreak promotes your learning about respiratory infectious diseases		
Yes	400	82.6
No	84	17.4
The COVID-19 outbreak raised your awareness of flu and flu vaccine.		
Yes	384	96.0
No	16	4.0
The COVID-19 Outbreak boosts your intention to get flu vaccinated.		
Yes	362	74.8
No	122	25.2

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451 Table 6. Analysis of factors influencing medical students' willingness to receive
452 vaccinations in 2021.

Variables	Number of people vaccinated (percentage%)	Number of unvaccinated persons (%)	OR value (95% CI)	P
Gender				
Male	49(27.4)	130(72.6)	1.136(0.747-1.726)	0.551
Female	76(24.9)	229(75.1)	Ref	
Age				
18-20	48(27.1)	129(72.9)	1.111(.7300-1.692)	0.622
21-23	77(25.1)	230(74.9)	Ref	
Grade Level				
Lower School	14(35.9)	25(64.1)	1.685(0.846-3.355)	0.137
Upper School	111(24.9)	334(75.1)	Ref	
GMI				
<¥4000	65(23.6)	210(76.4)	0.769(0.511-1.157)	0.207
≥¥4000	60(28.7)	149(71.3)	Ref	
Attitudes towards the flu vaccine				
Negative	1(7.1)	13(92.9)	Ref	0.140
Active	124(26.4)	346(73.6)	4.659(0.603-35.984)	

Level of knowledge				
Understanding	112(26.9)	304(84.7)	1.559(0.820-2.962)	0.443
Don't understand	13(19.1)	55(80.9)	Ref	
proactive about information about flu vaccines				
Yes	92(47.2)	103(52.8)	6.929(4.380-10.963)	<0.001
No	33(11.4)	256(88.6)	Ref	
learning about respiratory infectious diseases during the COVID-19 outbreak				
Yes	118(29.5)	282(70.5)	4.603(2.062-10.275)	<0.001
No	7(8.3)	77(91.7)	Ref	

Fig.1 Sources of Influenza Vaccine Information for 2019 vs. 2021

Fig. 2 Main reasons for not getting an influenza vaccination in 2019 vs. 2021

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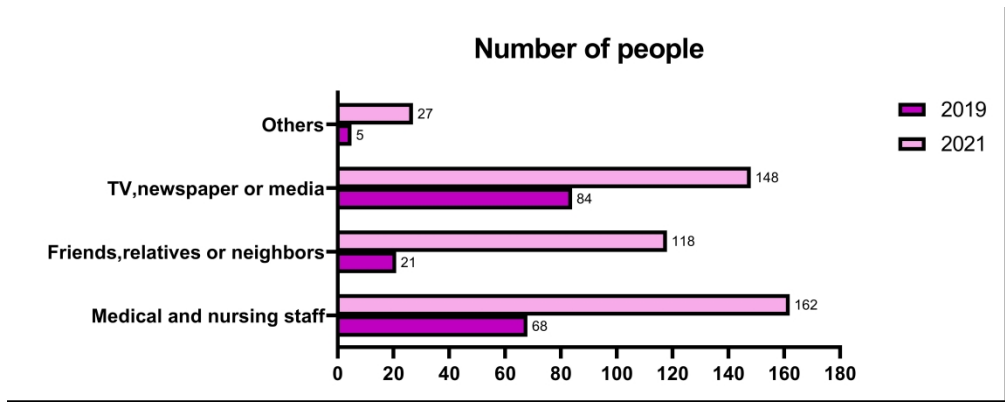
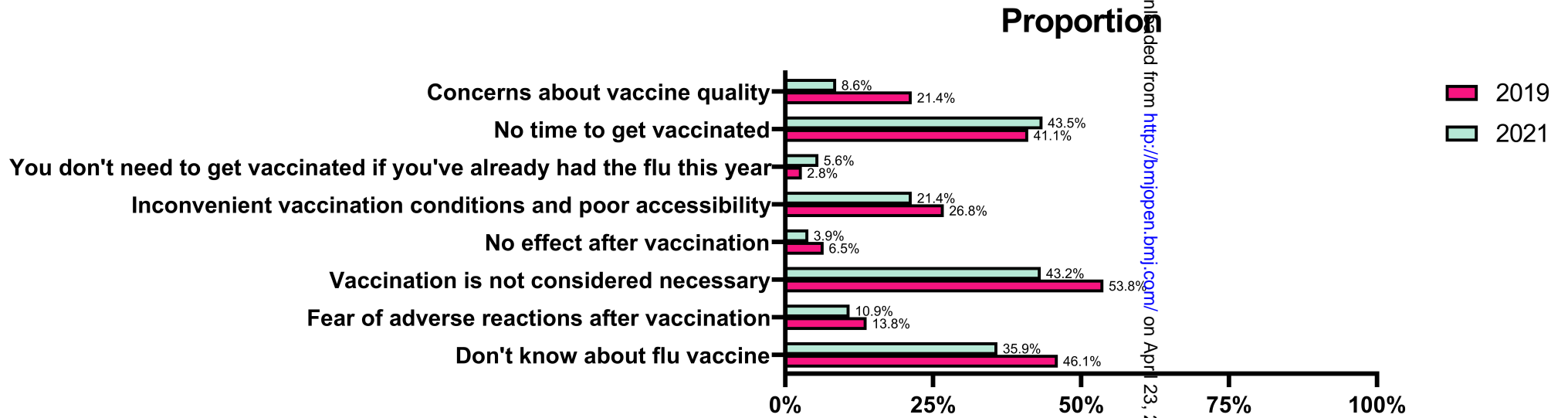


Fig. 1 Sources of Influenza Vaccine Information for 2019 vs. 2021

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STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1-2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5-6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7
Bias	9	Describe any efforts to address potential sources of bias	7
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5-6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7
		(b) Describe any methods used to examine subgroups and interactions	7
		(c) Explain how missing data were addressed	
		(d) If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	7
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8-9
		(b) Give reasons for non-participation at each stage	8-9
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8-9
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	8-17
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-17

		(b) Report category boundaries when continuous variables were categorized	8-17
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	8-17
Discussion			
Key results	18	Summarise key results with reference to study objectives	19-21
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	22-23
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	23
Generalisability	21	Discuss the generalisability (external validity) of the study results	21-23
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	24

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.