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RESEARCH PAPER

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Knowledge, Attitudes and Practices (KAP) toward seasonal influenza vaccine among young workers in South China

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ABSTRACT

Background: Vaccination against seasonal influenza is usually very protective. However, coverage in service workers is low due to the large population density and high turnover. The aim of this study was to document the knowledge, attitudes and practices towards the influenza vaccine among young service workers.

Methods: A face-to-face interview and questionnaire were administered at the Guangzhou Center for Disease Control and Prevention (GZCDC) clinic. The questionnaires were analyzed to evaluate knowledge, attitudes and willingness to vaccinate in the service industry population.

Results: Overall, the response rate was 81.37% (1035/1272). Most of the participants had faith in the efficacy (94.20%) and safety (94.88%) of the influenza vaccine. A total of 88.7% of the respondents confirmed that children needed to be vaccinated compared to other subjects, including those who work with baby and children (45.89%), elderly people (38.95%), medical staff (38.95%) and chronic disease patients (27.33%). Only 6.47% of the respondents were clearly aware of the vaccination timeframe. One-fifth of the respondents (18.16%) reported being vaccinated within the last three years, representing a low voluntary vaccination rate (23.94%) and a high irregular vaccination rate (77.13%). The primary reason for ignoring the importance of vaccination was that the respondents believed that they were strong enough to not require immunization (42.19%). In the multivariate analysis, the main determinants of the participants' willingness to continue to vaccinate were their beliefs in vaccine protection, a high education level, vaccination behavior over the last 3 years and belief in the necessity of annual vaccinations.

Conclusion: Our findings provide insights into the knowledge, attitudes and practices of the service industry population prior to vaccination season in Guangzhou City. Most participants had a passive attitude toward the influenza vaccine, but there was still relatively low knowledge and implementation of the vaccine. Governments and health departments at all levels should develop a long-term strategy for fiscal subsidy policies and new health education patterns to enhance both the recognition and coverage of the influenza vaccine and to protect the citizens as a whole from infection. There is an urgent need for the pharmaceutical industries to develop a universal vaccine and to enhance the efficacy of vaccination.

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Influenza; KAP; epidemiology; vaccine; questionnaire

Background

Seasonal influenza is one of the most widespread communicable diseases worldwide. According to the WHO's global estimates, 5–10% of adults and 20–30% of children contract influenza annually.[1] The situation is similar in China, with more than 215,000 people infected last year.[2] The influenza vaccine is considered one of the most common and effective methods to prevent infection.

Previous studies showed that the influenza vaccine was usually significantly protective and that most clinicians and family physicians were supportive of vaccination and had good knowledge of vaccination indications.[3-7] However, vaccination coverage was low in developing countries.[5,8,9] Related studies also noted that little progress had been made in the estimated global vaccination coverage from 2004 to 2013 in 195 countries.[10] A survey conducted to assess the factors associated with seasonal influenza vaccination found a strong link between household income and influenza vaccination.[11] We did not find many previous studies on this topic in China. According to some studies, even community healthcare workers do not have sufficient knowledge of the influenza vaccine, and their attitudes explicitly influence the vaccination rate among elderly people.[8,10] In Guangzhou, which is one of the largest cities in China, the influenza vaccination rate is not satisfactory. Therefore, we examined vaccination coverage and the associated underlying factors. Because young people are the most active population in terms of social activity, we considered this population, especially those who worked for the service industry, to play an active role in society, which made infection and transmission more likely. To evaluate the knowledge, attitudes and practices toward influenza

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Table 1. Demographic characteristics of the study participants in Guangzhou, July 20–31, 2015 (N = 1,035).

Demographic information	n	% (n/N*100%)	Coverage (a/n*100%)
Sex			
Male	327	31.59	3.36 (11/327)
Female	698	67.44	3.87 (27/698)
Age (years)			
< 20	172	16.62	6.40 (11/172)
20–29	645	62.32	2.95 (19/645)
> 29	218	21.06	3.67 (8/218)
Education			
Middle school	267	25.80	3.00 (8/267)
High school	324	31.30	4.01 (13/324)
College:1–3 years of technical school training	334	32.27	3.59 (12/334)
College graduate	105	10.14	2.86 (3/105)
Master's or above	5	0.48	40.00 (2/5)
Annual income			
$3001–6000	608	58.74	3.78 (23/608)
>$6000	427	41.26	6.09 (26/427)
Occupation			
Catering services	311	30.05	3.22 (10/311)
Commercial services	205	19.81	6.34 (13/205)
Public services	159	15.36	3.77 (6/159)
Student	136	13.14	3.68 (5/136)
Other	224	21.64	1.79 (4/224)

N represents the number of participants in this survey, n represents the number of participants for each demographic group, a represents the number of participants who received the seasonal influenza vaccination within the last 3 years. Coverage describes the vaccination rate over the last 3 years (coverage = n/N*100%).

vaccination among young service industry workers, we conducted a survey among 1,035 people mainly aged 20 to 40 years to identify significant factors that greatly influenced their actions toward vaccination. We hope that our results will provide more scientific and efficient strategies for the dissemination of influenza precautions and vaccination to intensify public health benefits.

Results

Demographics

A total of 1272 participants accepted the interview, of whom 1035 successfully completed the interview for a response rate of 81.37%. More females (N = 698, 67.44%) than males (N = 337, 32.56%) were involved in this study. The ages of the respondents ranged from 16 to 60 years, with a mean age of 25.39 years. The proportions of participants under 20, between 20 and 29, and over 30 years of age were 16.62%, 62.32% and 21.06%, respectively. All participants had a middle school diploma, and nearly half of them (N = 444, 42.90%) received a higher education. Most of the involved participants (N = 899, 86.86%) were engaged in the service industry, including catering and service, commercial service, public service and other service industries. Over half of the participants (N = 608, 58.74%) had an annual household income less than $6,000 (Table 1).

Knowledge

In this study, only one-fifteenth of the participants (N = 67, 6.47%) knew the influenza vaccination timeframe (October to December and January to March of the next year) clearly and exactly. Less than one-third of the participants at least partially knew the vaccination period; one-quarter of them (N = 263, 25.41%) knew of the recommended vaccination season in the spring, and fewer respondents (N = 161, 15.56%) knew of the recommended season in the winter. These proportions differed by age group ($p < 0.01$), with the older respondents more aware of the recommended seasons in the spring (30.73%) and in the winter (17.89%) (Table 2). A total of 31.11% of the participants checked the "Do not know" option for this question, and people with education less the high school level were more likely to be ignorant of the vaccination time periods ($p < 0.01$) (Table 3). Moreover, the respondents were unaware of the vaccination frequency, with nearly half of the participants (N = 471, 45.51%) considering annual influenza vaccinations unnecessary.

Regarding knowledge of the priority population for the influenza vaccine, the highest proportion of responses was "children between 6 months and 5 years old" (88.70%), followed by "those who work with baby and children" (45.89%), "elderly people older than 60 years" (38.95%), "medical staff" (38.95%), and "chronic disease patients" (27.33%) (Table 2). Compared to the citizens with low education levels, the respondents with college diplomas or higher had greater knowledge of the recommended population for influenza vaccination ($p < 0.05$ for the "those who work with baby and children" item and $p < 0.01$ for the "elderly people" "medical staff" and "chronic disease patients" items) (Table 3).

Table 2. Knowledge of the influenza vaccine among employees of food production and operations in Guangzhou, July 20–31, 2015 (N = 1,035).

Knowledge	n	% (n/N*100%)	95% CI lower	95% CI upper
What population needs the influenza vaccine? (multiple choice)				
Children (6 months to 5 years old)	918	88.70	86.77	90.62
Elderly people (>60 years)	382	36.91	33.97	39.85
Chronic disease patients	265	25.60	22.94	28.26
Medical staff	371	35.85	32.92	38.77
Those who work with baby and children	475	45.89	42.86	48.93
What seasons are recommended for influenza vaccination? (multiple choice)				0.34
January to March	263	25.41	22.76	28.06
April to June	331	31.98	29.14	34.82
July to September	258	24.93	22.29	27.56
October to December	161	15.56	13.35	17.76
Do not know	322	31.11	28.29	33.93
How necessary do you think vaccinating every year is?				
Necessary	546	52.75	49.71	55.80
Not necessary	471	45.51	42.47	48.54

Table 3. Knowledge of the influenza vaccine in the age, education and income group analysis- July 20–31, 2015 (N = 1,035).

	Young (n = 172)	%	Middle (n = 645)	%	Elder (n = 218)	%	X^2	*p*	Education1 (n = 591)	%	Education2 (n = 444)	%	X^2	*p*	$3001-$6000 (n = 608)	%	>$6000 (n = 427)	%	X^2	*p*
Knowledge																				
What population needs the influenza vaccine? (multiple choice)																				
Children (6 months to 5 years old)	157	91.28	595	92.25	166	76.15	0.34	0.84	510	86.29	408	91.89	0.80	0.37	553	90.95	365	85.48	0.77	0.38
Elderly people (>60 years)	67	38.95	251	38.91	64	29.36	0.82	0.37	168	28.43	214	48.20	20.11	<0.001	238	39.14	144	33.72	0.82	0.37
Chronic disease patients	47	27.33	178	27.60	40	18.35	0.79	0.67	117	19.80	148	33.33	12.83	<0.001	165	27.14	100	23.42	0.00	0.95
Medical staff	67	38.95	253	39.22	51	23.39	0.32	0.85	157	26.57	214	48.20	22.32	<0.001	221	36.35	150	35.13	0.11	0.74
Those who work with baby and children	78	45.35	317	49.15	80	36.70	2.33	0.31	238	40.27	237	53.38	5.35	0.02	271	44.57	204	47.78	1.76	0.18
What seasons are recommended for influenza vaccination? (multiple choice)																				
January to March	33	19.19	163	25.27	67	30.73	18.76	<0.001	150	25.38	113	25.45	0.08	0.78	162	26.64	101	23.65	0.34	0.56
April to June	46	26.74	218	33.80	67	30.73	10.26	0.01	165	27.92	166	37.39	3.84	0.05	201	33.06	130	30.44	0.02	0.89
July to September	48	27.91	172	26.67	38	17.43	0.52	0.77	143	24.20	115	25.90	0.02	0.88	150	24.67	108	25.29	0.43	0.51
October to December	20	11.63	102	15.81	39	17.89	10.30	0.01	76	12.86	85	19.14	5.40	0.02	99	16.28	62	14.52	0.14	0.71
Do not know	65	37.79	208	32.25	49	22.48	0.59	0.74	213	36.04	109	24.55	14.75	<0.001	192	31.58	130	30.44	0.13	0.72
How necessary do you think vaccinating every year is?							0.78	0.68					1.39	0.24					0.32	0.57
Necessary	88	51.16	353	54.73	105	48.17			318	53.81	228	51.35			315	51.81	231	54.10		
Not necessary	81	47.09	309	47.91	81	37.16			257	43.49	214	48.20			280	46.05	191	44.73		

Attitudes

In contrast to the relatively low awareness rate of influenza vaccine knowledge, the majority of the participants had high recognition of the effects and safety of the current influenza vaccine. Most of the participants (N = 975, 94.2%) believed that they would be protected by the influenza vaccine, and a large portion of them (N = 982, 94.88%) believed that the vaccine was safe (Table 4). This recognition of the safety varied when analyzed based on some demographic information ($p < 0.01$) (Table 5). For instance, participants who were in the middle age group and those who had higher education levels tended to be more realistic in their responses to attitudes toward vaccine safety, which were 1.5 times greater than the attitudes of the other two age groups (73.02% *vs.* 63.37% and 49.08%) and 1.2 times greater than the attitudes of the low education level group (73.42% *vs.* 61.08%).

Moreover, a large majority of the respondents (N = 828, 80.0%) worried about contracting influenza. The middle age group had a higher response rate for "very worried" than did the other two groups (22.23% *vs.* 18.02% and 12.39%, $p < 0.05$) (Table 5).

Practices

Only one-fifth of the respondents (N = 188, 18.16%) reported being vaccinated for influenza within the last three years. Characteristically, young people had a tendency to receive vaccinations, and the practice of vaccination had the following 3 features (Table 6, 7). First, we found a high proportion of irregular vaccination, with only four-fifths of the citizens reporting having ever been vaccinated (N = 145, 77.13%); thus, some respondents did not obey the annual vaccination recommendations. Second, a low proportion of the respondents participated in voluntary vaccinations, with only one-fourth (N = 45, 23.94%) of the citizens initiating the vaccination, of whom half were in the high-income group (N = 22, 33.33%, $p < 0.01$). Most of the participants were vaccinated for their jobs (N = 58, 30.85%), according to doctor recommendations (N = 71, 37.77%) or had a higher education level and were more likely to follow their doctors' suggestions (47.25% *vs.* 28.87%). The primary reasons that four-fifths of the citizens were not vaccinated within the last three years was that they believed that they were strong enough to not be immunized (N = 351, 42.19%) and were unaware of vaccination sites (N = 346, 41.59%). Additionally, the "high cost" responses differed by age and education level, the "unsafe" responses differed by age and income level, and the "limited effect" responses differed by age ($p < 0.01$). Third, willingness to undergo a subsequent vaccination was associated with the former vaccination experience. Half of the previously vaccinated citizens (N = 96, 51.06%) had intentions to continue to receive protection from influenza by vaccination, whereas the never vaccinated group mostly maintained a wait-and-see attitude (N = 550, 66.11%).

Multivariate analysis

Using the willingness to be vaccinated as the primary outcome, we conducted multivariate analyses to determine which independent variables were significant in a logistic regression model. The results are shown below. For the demographic elements, a high education level (OR = 1.49, $p < 0.05$) and occupations in catering and public service (OR = 1.97, $p < 0.05$) were two significantly influencing elements, whereas the variables annual income and sex were not significant. Four elements representing knowledge, attitudes and practices were associated with willingness to accept the influenza vaccine. "Heard of the influenza vaccine" (OR = 2.20, $p < 0.05$) and "annual vaccination is necessary" (OR = 1.69, $p < 0.01$) were significant from the knowledge section. "Believe that the influenza virus vaccine can protect you from getting influenza" (OR = 3.329, $p < 0.05$) was significant for the attitude section. "Vaccination within the last 3 years" (OR = 4.28, $p < 0.01$) was significant for the practice section (Table 8).

Discussion

To the best of our knowledge, this study is one of the first to measure the general service industry population's KAP toward the influenza vaccine. Previous studies among health

Table 4. Attitudes towards influenza vaccine among employees of food production and operations in Guangzhou, July 20–31, 2015 (N = 1,035).

Attitude	n	% (n/N*100%)	95% CI lower	95% CI upper
Do you worry about getting influenza?				
Very worried	202	19.52	17.10	21.93
Worried	626	60.48	57.50	63.46
Not worried	206	19.90	17.47	22.34
Have you ever heard of the influenza vaccine?				
Yes	938	90.63	88.85	92.40
No	83	8.02	6.36	9.67
Do you think the influenza virus vaccine can protect you from getting influenza?				
Yes	975	94.20	92.78	95.63
No	52	5.02	3.69	6.35
How safe do you think the influenza vaccine is?				
It is safe and with no side effects.	295	28.50	25.75	31.25
It is basically safe and with some side effects.	687	66.38	63.50	69.25
It is not safe and with obvious side effects.	40	3.86	2.69	5.04
Will you advise your family and friends to be vaccinated with the influenza vaccine?				
Yes	898	86.76	84.70	88.83
No	132	12.75	10.72	14.79

Table 5. Attitudes towards the influenza vaccine in the age, education and income group analysis- July 20–31, 2015 (N = 1,035).

	Young (n = 172)	%	Middle (n = 645)	%	Elder (n = 218)	%	X^2	*p*	Education1 (n = 591)	%	Education2 (n = 444)	%	X^2	*p*	$3001-$6000 (n = 608)	%	>$6000 (n = 427)	%	X^2	*p*
Attitude																				
Do you worry about contracting influenza?							7.41	0.03					0.16	0.69					0.01	0.99
Very worried	31	18.02	144	22.33	27	12.39			126	21.32	76	17.12			107	17.60	95	22.25		
Worried	106	61.63	405	62.79	115	52.75			349	59.05	277	62.39			379	62.34	247	57.85		
Not worried	34	19.77	120	18.60	52	23.85			115	19.46	91	20.50			121	19.90	85	19.91		
Have you ever heard of influenza vaccine?							0.62	0.73					7.41	0.01					4.25	0.04
Yes	157	91.28	604	93.64	177	81.19			522	88.32	416	93.69			561	92.27	377	88.29		
No	12	6.98	57	8.84	14	6.42			59	9.98	24	5.41			40	6.58	43	10.07		
Do you think the influenza virus vaccine can protect you from getting influenza?							0.69	0.71					0.54	0.46					0.54	0.46
Yes	161	93.60	634	98.29	180	82.57			558	94.42	417	93.92			575	94.57	400	93.68		
No	8	4.65	32	4.96	12	5.50			28	4.74	24	5.41			28	4.61	24	5.62		
How safe do you think the influenza vaccine?							18.62	<0.001					14.21	<0.001					3.32	0.19
It is safe and with no side effects	56	32.56	164	25.43	75	34.40			189	31.98	106	23.87			177	29.11	118	27.63		
It is basically safe and has some side effects.	109	63.37	471	73.02	107	49.08			361	61.08	326	73.42			405	66.61	282	66.04		
It is not safe and has obvious side effects.	4	2.33	28	4.34	8	3.67			28	4.74	12	2.70			18	2.96	22	5.15		
Will you advise your family and friends to inject influenza vaccine?							2.09	0.35					0.34	0.56					0.06	0.80
Yes	152	88.37	575	89.15	171	78.44			514	86.97	379	85.36			527	86.68	371	86.89		
No	18	10.47	93	14.42	21	9.63			72	12.18	65	14.64			79	12.99	53	12.41		

Table 6. Practices towards the influenza vaccine among employees of food production and operations in Guangzhou, July 20–31, 2015 (N = 1,035).

Action and reasons	n	% (n/N*100%)	95% CI lower	95% CI upper
Have you been vaccinated with the influenza vaccine within the past three years?				
Yes	188	18.16	15.82	20.51
Every year	38	20.21	25.26	48.17
Every 2–3 years	69	36.70	29.81	43.59
Occasionally	76	40.43	33.41	47.44
The approach that led you to be vaccinated with the influenza vaccine (multiple choice):				
Job demand	58	30.85	24.25	37.45
Advised by doctor	71	37.77	30.84	44.70
Voluntarily vaccinated	45	23.94	17.84	30.04
Recommended by family members or friends	40	21.28	15.43	27.13
Other approaches	13	6.91	3.29	10.54
Willingness to continue vaccinating:				
Yes	96	51.06	43.92	58.21
No/depends	89	47.34	40.20	54.48
The reason you will not to continue to vaccinate:				
High cost	17	19.10	10.93	27.17
Limited effect	36	40.45	30.25	50.65
Side effects and poor safety	11	12.36	5.52	19.20
Limited vaccination sites	35	39.33	29.18	49.47
Other reasons	11	12.36	5.52	19.20
No	832	80.39	77.97	82.81
The reason you did not vaccinate:				
High cost	123	14.78	12.37	17.20
Influenza is not a serious disease	351	42.19	38.83	45.54
Unsafe	208	25.00	22.06	27.94
Limited effects	151	18.15	15.53	20.77
Unknown vaccination sites	346	41.59	38.24	44.94
No time	298	35.82	32.56	39.08
Never been recommended by the community	106	12.74	10.47	15.01
Others	50	6.01	4.39	7.62
Do you intend to vaccinate in the future?				
Yes	162	19.47	16.78	22.16
No	106	12.74	10.47	15.01
Depends	550	66.11	62.89	69.32

care workers, travelers, physicians and pregnant women reported that coverage of the influenza vaccine was extremely low.[4,5,8,12,13]

Under the national conditions of a large population density and high turnover and the current situation of the relatively low vaccination rate, all populations above 6 months of age are recommended to be vaccinated from September to November. This policy is similar to the policy in the USA,[14] although healthy adults are not in the scope of the WHO priority or considered a high-priority population. In this study, only 18.16% of the service industry population self-reported vaccination within the last three years; thus, the estimated annual coverage could be 5.00–6.00%, which was similar to the whole population coverage in Guangzhou City (between 3.69% and 5.38% from 2011 to 2014). The estimated coverage was less than the effective rate (>60%) needed for all populations to form an immune protective barrier and was far below the influenza vaccination coverage in European countries (35.6%) and the USA for specific population groups.[15,16] The ongoing high prices and self-financed policy in most cities in China are significant economic barriers for the increasing demand. As pilot reform cities, Beijing and Xinjiang implemented a policy of fiscal subsidies for the self-paid population and free charges for primary and secondary school students and the elderly above 60 years of age in 2007. Thereafter, the coverage in Beijing for the elderly was 64.01% in 2008, which was higher than the coverage in 2007 (31.84%) and in other cities (5.39% in Hangzhou and 11.1% in Tianjin). The government of Zhuhai city in the southern part of China added the influenza vaccine to medical insurance for urban residents and yielded a high demand in citizens. In the USA, the overall coverage in 2012 and 2013 was 45.0% and 70.4%, respectively, and coverage was greater than 50% in nearly half of the states, which was a benefit of the robust insurance system. Region-specific information about the disease burden, fiscal capacity and cost-effectiveness is important for the development of local financing policies to cover vaccination costs.[17,18]

Physicians play a key role in the public's acceptance of vaccines, and their recommendations are an important determinant of vaccination.[4,5,10,11,14-16,18] In our study, only 37.77% of the participants were vaccinated after their clinical doctors' recommendations. Lack of initiative suggestions from a clinical doctor may be a direct factor in the low vaccination rate in the young working population. However, there is insufficient adherence to influenza vaccination among health care workers (HCWs) due to concerns about the efficacy of influenza immunization and fear of adverse events or serious side effects, although these workers are knowledgeable of the effects of self-protection and public protection. Therefore, physicians and HCWs rarely provide vaccination recommendations. The European Centre for Disease Prevention and Control and other researchers studied this so-called "vaccine hesitancy" phenomenon and determined that the major determinants were concerns about vaccine safety and mistrust of the pharmaceutical industry.[19-21] We believe that offering recommendations by physicians or HCWs is the most convenient and effective approach to improve vaccination-related knowledge and ultimately to transfer vaccination behavior and habits to young workers. However, the fundamental driver of

Table 7. Practices towards the influenza vaccine in the age, education and income group analysis- July 20–31, 2015 (N = 1,035).

	Young (n = 172)	%	Middle (n = 645)	%	Elder (n = 218)	%	X^2	*p*	Education1 (n = 591)	%	Education2 (n = 444)	%	X^2	*p*	$3001-$6000 (n = 608)	%	>$6000 (n = 427)	%	X^2	*p*
Q1: Have you been vaccinated with the influenza vaccine within the past three years?							7.80	0.02					2.61	0.11					3.40	0.07
Yes (go to Q2)	44	25.58	112	17.36	32	14.68			97	16.41	91	20.50			122	20.07	66	15.46		
No (finish Q6 and Q7)	125	72.67	548	84.96	159	72.94			483	81.73	349	78.60			479	78.78	353	82.67		
Q2: The frequency of influenza vaccination							3.55	0.47					0.55	0.76					0.72	0.70
Every year	11	25.00	19	16.96	8	25.00			21	21.65	17	18.68			23	18.85	15	22.73		
Every 2–3 years	15	34.09	46	41.07	8	25.00			33	34.02	36	39.56			47	38.52	22	33.33		
Occasionally	16	36.36	46	41.07	14	43.75			38	39.18	38	41.76			48	39.34	28	42.42		
Q3: The approach that led you to be vaccinated with the influenza vaccine (multiple choice)																				
Job demand	12	27.27	33	29.46	13	40.63	7.83	0.02	35	36.08	23	25.27	0.91	0.34	34	27.87	24	36.36	1.51	0.22
Advised by doctor	13	29.55	44	39.29	14	43.75	3.08	0.21	28	28.87	43	47.25	11.31	<0.001	51	41.80	20	30.30	0.36	0.55
Voluntarily vaccinated	8	18.18	28	25.00	9	28.13	1.52	0.47	25	25.77	20	21.98	0.15	0.70	23	18.85	22	33.33	9.11	0.00
Recommended by family members or friends	13	29.55	26	23.21	1	3.13	4.21	0.12	19	19.59	21	23.08	0.54	0.46	30	24.59	10	15.15	1.50	0.22
Other approaches	7	15.91	5	4.46	1	3.13	4.98	0.08	7	7.22	6	6.59	0.04	0.84	13	10.66	0	0.00	6.04	0.01
Q4: Willingness to continue to vaccinate:																				
Yes	23	52.27	57	50.89	16	50.00	2.12	0.71	53	54.64	43	47.25	1.47	0.48	67	54.92	29	43.94	3.37	0.19
No/maybe (go to Q5)	20	45.45	53	47.32	16	50.00			43	44.33	46	50.55			52	42.62	37	56.06		
Q5: The reason you will not continue to vaccinate (multiple choice):																				
High cost	3	6.82	10	8.93	4	12.50	0.22	0.89	8	8.25	9	9.89	0.17	0.68	10	8.20	7	10.61	0.60	0.44
Limited effects	11	25.00	21	18.75	4	12.50	3.69	0.16	17	17.53	19	20.88	0.37	0.54	19	15.57	17	25.76	3.90	0.05
Side effects and poor safety	0	0.00	9	8.04	2	6.25	3.94	0.14	4	4.12	7	7.69	0.46	0.50	9	7.38	2	3.03	1.01	0.32
Limited vaccination sites	8	18.18	21	18.75	6	18.75	0.22	0.90	15	15.46	20	21.98	1.43	0.23	21	17.21	14	21.21	1.43	0.23
Other reasons	0	0.00	7	6.25	4	12.50	4.46	0.11	7	7.22	4	4.40	1.30	0.26	7	5.74	4	6.06	0.53	0.47
Q6: The reason you did not vaccinate (multiple choice):																				
High cost	14	11.20	79	14.42	30	18.87	8.55	0.01	81	16.77	42	12.03	5.45	0.02	77	16.08	46	13.03	0.96	0.33
Immune to influenza	60	48.00	226	41.24	65	40.88	4.10	0.13	182	37.68	169	48.42	3.60	0.06	189	39.46	162	45.89	3.47	0.06
Unsafe	19	15.20	147	26.82	42	26.42	12.43	0.00	129	26.71	79	22.64	3.05	0.08	104	21.71	104	29.46	5.12	0.02
Limited effects	12	9.60	100	18.25	39	24.53	14.68	0.00	88	18.22	63	18.05	0.47	0.49	88	18.37	63	17.85	0.07	0.79
Did not know = vaccination sites	50	40.00	241	43.98	55	34.59	1.10	0.58	188	38.92	158	45.27	0.83	0.36	189	39.46	157	44.48	2.42	0.12
No time	59	47.20	204	37.23	35	22.01	5.20	0.07	163	33.75	135	38.68	0.11	0.75	169	35.28	129	36.54	0.46	0.50
Never been recommended by The community	17	13.60	79	14.42	10	6.29	2.46	0.29	52	10.77	54	15.47	2.40	0.12	61	12.73	45	12.75	0.01	0.94
Others	11	8.80	26	4.74	13	8.18	6.18	0.05	30	6.21	20	5.73	0.44	0.51	30	6.26	20	5.67	0.04	0.83
Q7: Do you intend to vaccinate in the future?							0.81	0.94					12.40	0.00					6.26	0.04
Yes	21	16.80	111	20.26	30	18.87			77	15.94	85	24.36			81	16.91	81	22.95		
No	16	12.80	70	12.77	20	12.58			56	11.59	50	14.33			56	11.69	50	14.16		
Maybe	85	68.00	358	65.33	107	67.30			342	70.81	208	59.60			331	69.10	219	62.04		

Table 8. Multivariate regression analysis of the impact of various factors on the willingness to accept the seasonal influenza vaccine.

							95% CI for EXP (B)	
	B	S.E.	Wald	df	Sig.	Exp (B)	Lower	Upper
Sex								
Female						1.00		
Male	0.13	0.17	0.54	1.00	0.46	1.14	0.81	1.59
Age	0.06	0.14	0.19	1.00	0.66	1.06	0.81	1.40
Education								
Below high school						1.00		
High school or above	0.40	0.17	5.76	1.00	0.02	1.49	1.08	2.08
Income								
<$6000						1.00		
>$6000	0.18	0.17	1.11	1.00	0.29	1.20	0.86	1.67
Occupation								
Commercial			10.03	3.00	0.02	1.00		
Teacher, student and officer	−0.25	0.31	0.68	1.00	0.41	0.78	0.43	1.42
Food & catering, public service	0.68	0.23	8.57	1.00	0.00	1.97	1.25	3.11
Unidentified	−0.52	0.27	3.57	1.00	0.06	0.60	0.35	1.02
Has heard of the influenza vaccine:								
No						1.00		
Yes	0.79	0.36	4.71	1.00	0.03	2.20	1.08	4.48
Believes that the influenza virus vaccine can protect from influenza?								
No						1.00		
Yes	1.20	0.54	5.00	1.00	0.03	3.33	1.16	9.55
Necessity of vaccinating every year:								
No						1.00		
Yes	0.52	0.16	10.46	1.00	0.00	1.69	1.23	2.32
Received influenza vaccine within the last 3 years:								
No						1.00		
Yes	1.45	0.18	64.44	1.00	0.00	4.28	3.00	6.11

vaccination depends on improving vaccine-manufacturing companies' credibility through sufficient communications about vaccine safety problems.

The free-riding phenomenon is a social factor that impacts vaccination behavior and decisions. In economic theory, a free-riding problem occurs in the market of public goods with two main characteristics: non-rivalry and non-exclusion of consumption. Vaccination produces externalities that reduce the transmission of a disease and thus can provide an incentive for individuals to be free-riders who benefit from the vaccination of others while avoiding the cost of vaccination. Ibuka Y's experimental study[22] found that as the proportion of vaccination among other group members increased, the likelihood of an individual choosing to get vaccinated in the following game round decreased, implying a free-riding motive for vaccination. These authors also found that the probability of vaccination acceptance increased with the exposure of a player to influenza during the game. The free-riding phenomenon revealed that vaccination acceptance could be interpreted in terms of changes in the individual's perceived risk of infection. In our study, we found that the primary reasons that participants chose not to be vaccinated or not to continue vaccination were limited effects (40.45%) and the notion that influenza was not a serious disease (42.19%). These findings suggested that when individuals balanced the risk of infection and the effect of vaccination, a certain percentage of people chose to be free-riders. Therefore, raising awareness of the influenza infection risk and prevention is necessary, and the development of a universal vaccine as well as new anti-influenza drugs and therapies to enhance the effect of vaccination is urgently needed.[23-25]

Service industry population

The other important result of this study is that we found nonconformity in the knowledge, attitudes and practices of the service industry population. Although the respondents had some knowledge and a passive attitude towards the influenza vaccine, the demand and acceptance were still low. We suspect that overly optimistic risk prediction for influenza infection may be the main cause of the low response to vaccination recommendations. First, in the multivariate analysis, the attitude element "Believe that the influenza virus vaccine can protect you from getting influenza" (OR = 3.329, $p < 0.05$) was the most influential factor for the decision to continue to vaccinate. Second, significantly more participants who had never been vaccinated (27.07%) than vaccinated participants (19.90%) did not worry about infection in this study. Therefore, our findings revealed that attitude was a more direct factor than knowledge in terms of impact on vaccination practices. Compared to the children's cognitive-behavioral model, the behavior of the service industry population was based on more complex cognitive competence abilities and their experiences. Thus, to improve citizen's cognition and turn knowledge to a high level of belief in and acceptance of the influenza vaccine, we have to adjust our one-way health education to bilateral interacting education and emphasize feedback from adults to reinforce the unification of knowledge, attitudes and practices.

Humans and viruses are the two important elements that control influenza disease. Regarding the human aspect, strengthening citizens' awareness of influenza vaccination and enhancing the vaccination rate are the most practical

current methods. Therefore, we propose that the government and health authorities need to develop a long-term strategy. First, the experimental unit city for the fiscal subsidies policy for the high-risk service industry population should continue to expand. Second, interagency cooperation and the liaison mechanism should be strengthened between the treatment and prevention departments to impel the vaccination program. Specifically, vaccination sites should be added in hospitals, and health education classes should be promoted in cooperation with clinical doctors because health workers' knowledge of vaccines has been shown previously to be a main determinant of their intention to recommend the vaccine to their patients.[26] Regarding the viral aspect, influenza vaccine and antiviral drug research and development have put considerable effort into fighting the influenza virus for one hundred years. However, the various types of vaccines (i.e., inactivated influenza vaccines, split vaccines, subunit vaccines, and the quadrivalent inactivated vaccine) indicate a reality in which no one can be protected against all influenza viral strains because strains are constantly mutating. Moreover, the virus is demonstrating gradually emerging resistance to antiviral drugs. Therefore, the focus on a universal influenza vaccine and new antiviral drug research and development is an important aspect to overcoming the challenges faced due to antigenic drift and shift or co-circulation of different viral strains. In the face of an influenza pandemic, a more important priority is sustainable vaccine production platforms, which are indispensable for meeting the large global demands for an influenza vaccine.[23,24]

Some limitations of this study must be acknowledged. First, our subjects were food production and operations employees, and we recognize the limitations of applying the results of this study to the general population. Second, this survey was conducted before the vaccination season; therefore, the attitudes and practices reflected only the information available at that time. The third limitation is that we used only convenience sampling as opposed to random sampling; therefore, some inherent selection bias that diminished the internal validity must be inherent from the study design.

Conclusions

Despite these limitations, our study conducted a rigorous analysis of the knowledge, attitudes and practices toward the influenza vaccine in the service industry population in Guangzhou City and provided the following valuable insights. 1) Although the majority of the participants had knowledge concerning the recommended population for the influenza vaccine, they did not know the exact vaccination timeframe and frequency. 2) The great majority of the participants had high recognition of both the side effects and safety of the current influenza vaccine, but their willingness to vaccinate was ambiguous and associated with their former vaccination experience. 3) Due to high fluidity, the annual coverage of the service industry population was too low (5.00–6.00%) to form an immune protective barrier. The main determinants of the participants' willingness to continue vaccination were their beliefs in vaccine protection, a high education level, vaccination behavior over the last 3 years and belief in the necessity of annual vaccination. Because the service industry population plays a key role in spreading the virus, these findings should be used to develop a better strategy for health education of the influenza vaccine and to enhance influenza control and prevention.

Methods

Participant selection

In China, according to the Public Places Health Management Regulations and Implementing Rules promulgated by the Chinese government, employees in food production and operations must undergo a health examination every year, and engaging in food-related work without a valid health certificate is illegal. The Guangzhou Center for Disease Control and Prevention (CDC) Health examination center is the largest certificated health examination center and typically is the first choice for employees. In this study, the object of the investigation was employees working in food production and operations and commercial services who had lived in Guangzhou for at least 3 months. All respondents seeking health examinations from the Guangzhou CDC health examination center between July 20 and 31, 2015, were recruited by convenience sampling. All subjects who agreed to participate in the investigation completed a face-to-face interview, followed by a 2-page questionnaire.

Data collection and quality management

This survey was approved by the Ethics Committee of the Guangzhou Center for Disease Control and Prevention. All patients provided informed consent before completing the questionnaire survey. Pilot surveys were conducted before the study to guarantee both the validity and logicality of the questionnaire content and order. Based on the pilot survey results, the final version of the influenza vaccine KAP consisted of 4 sections that collected the following data: (i) demographic information (5 items): sex, age, household income, education level and occupation; (ii) knowledge of the influenza vaccine (3 items); (iii) attitude toward the influenza vaccine (5 items); and (iv) influenza vaccine practices (3 items). All questions were either closed-ended or multiple-choice.

The interviewers were epidemiologists and dialect interpreters and spent an average of 3 hours recruiting participants at a randomly chosen time of day. Each interview lasted approximately 20 minutes. All interviewers attended a 3-hour pre-training session prior to conducting the interviews. Because some questions in this study concerned government work, the responses may have been untruthful if the participants knew that the Guangzhou CDC was conducting this investigation; therefore, we masked our occupation when explaining the nature of this study to the interviewees.

Knowledge

Three questions were used to assess knowledge about the influenza vaccine and the approaches used to obtain this knowledge.

The first question was "What population needs the influenza vaccine?"; the response options were "Elderly people (>60 years of age)," "Children (6 months – 5 years old)," "Chronic disease patients," "Medical staff" and "Those who work with baby and children." The second question was "What seasons are recommended for influenza vaccination?"; the response options were "January to March," "April to June," "July to September," and "October to December." The third question was "How necessary do you think vaccinating every year is?"; the response options were "Necessary" and "Not necessary." The first two questions were multiple choice, and the last question was single choice.

Attitudes

The participants were asked 5 questions about their attitudes toward seasonal influenza and vaccination. All of the questions were single choice. The first question was "Do you worry about getting influenza?"; the response options ranged from 1 = "Very worried" to 3 = "Not worried." The next three questions were "Have you ever heard of the influenza vaccine?", "Do you think the influenza virus vaccine can protect you from getting influenza?", and "Will you advise your family and friends to receive the influenza vaccine?"; the response options for these questions were "Yes" and "No". The last question was "How safe do you think the influenza vaccine is?"; the response options ranged from 1 = "Safe and with no side effects" to 3 = "Not safe and with obvious side effects."

Practices

Three questions were used to assess the participants' practices for influenza vaccination and the reasons for refusal of vaccination. The first question was "Have you been vaccinated for influenza within the last three years?"; the response options were "Yes" and "No". The participants who chose "Yes" were asked to report their vaccination frequency and the approach by which they obtained the vaccine. The participants that chose "No" were asked to report the reason for not vaccinating. The other question was "Will you continue (or do you intend to) vaccinate in the future?"; the response options were "Yes," "No" and "Maybe"

Data analysis

Data from the questionnaires were entered in duplicate and verified using Epi Data 3.1 (Odense, Denmark; available at http://www.epidata.dk/). SPSS (version 17.0; SPSS Inc., Chicago, IL, USA) was used for the data analysis. Mean and variance values were calculated for continuous variables. Because the "Age" variable displayed a positive deviation, we divided the participants into the following three age groups: "Middle-aged", who were aged from 20 to 29 years, "Young", who were aged under 20 years, and "Elder", who were aged above 29 years. Based on the occupation feature, we classified the participants into the following 5 occupation groups, "Catering services," "Commercial service," "Public service," "Student" and "Other." For the knowledge, attitude and practice section, all categorical variables were described with frequencies and proportions. The multiple-choice questions were described using a multiple response method. The χ^2 test and/or Fisher's exact test was used to compare proportions of different ages, family incomes and education groups. Multivariate logistic regression analyses were used to clarify the relationships between willingness to vaccinate with the seasonal influenza vaccine and vaccine knowledge, attitudes and demographic variables. The significant independent predictors of acceptance of a seasonal influenza vaccine were identified by calculating odds ratios (ORs) after controlling for sex, age, and other demographic information.

Abbreviations

CI	confidence intervals
GZCDC	Guangzhou Center for Disease Control and Prevention organization
KAP	Knowledge, Attitudes and Practices

Disclosure of potential conflicts of interest

No potential conflicts of interest were disclosed.

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Availability of data and material

Data sharing: Participant level data are available from the authors upon request.

Author contributions

ZCY and TGL designed the study described in this article. WQC and MXL conducted the investigation and participated in data collection, and YM oversaw all aspects of data collocation. YM conducted the statistical analyses, and WQC participated in some of the statistical analyses. YM wrote the preliminary and the corrected versions of the manuscript with advice from TGL and ZCY. All authors contributed to the study design, conduct of the study, and the final manuscript. All authors have read and approved the final manuscript.

Ethics approval and consent to participate

The Ethics Committee of the Guangzhou Center for Disease Control and prevention approved the study. Informed consent to utilize the collected information for research purposes was obtained from all participants.

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