Employees' Willingness to Pay to Prevent Influenza

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Objectives: To quantify employees' preferences, as measured by willingness to pay, to prevent influenza in themselves and in their child and adult household members and to examine factors associated with willingness to pay.

Study Design: Prospective observational cohort study of a convenience sample of employees from 3 large US employers. Participants had at least 1 child (≤17 years) living in their household for at least 4 days per week.

Methods: Each month from November 2007 to April 2008, employees completed Web-based surveys regarding acute respiratory illness in their household. In the final survey, employees were presented with descriptions of influenza and questions regarding their willingness to pay to prevent influenza. Factors associated with willingness to pay were examined using multivariate ordinary least squares regression analysis of the log of willingness to pay.

Results: Among 2006 employees, 31.3% were female, the mean age was 41.7 years, 85.3% were of white race/ethnicity, and the mean household size was 4.0. Employees' median (mean) willingness to pay to prevent influenza was $25 ($72) for themselves, $25 ($82) for their adult household members, and $50 ($142) (P <.01) for children. However, influenza vaccination rates were approximately equal for children (27.5%), employees (31.5%), and other adult household members (24.5%). This finding may be explained by barriers such as cost, dislike of vaccinations, and disagreement with national influenza vaccination recommendations, which were significantly associated with lower willingness to pay for prevention of influenza (P <.05).

Conclusion: Employees expressed a stronger preference to prevent influenza in their children than in themselves or other household members; however, modifiable barriers depress vaccination rates.

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For author information and disclosures, see end of text.

Every year, about 10% to 20% of individuals in the United States contract influenza.[1] With this incidence comes a substantial clinical and economic burden. Approximately 36,000 deaths and 226,000 hospitalizations are associated with influenza epidemics each year.[2,3] The total cost of influenza epidemics in the United States has been estimated in the tens of billions of dollars (US) per year, much of which is due to lost productivity.[4,5]

Yearly seasonal influenza vaccination is recommended by the Centers for Disease Control and Prevention (CDC) as the first and most important step in protecting against contracting and spreading seasonal influenza, as supported by studies.[6-12] In the United States, target populations for vaccination include children aged 6 months through 18 years, individuals with underlying medical conditions, pregnant women, adults 50 years and older, and healthcare workers and household contacts of individuals at high risk for influenza complications.[13] However, influenza vaccination coverage for the general population and for target groups remains suboptimal.[13] Several studies[14-16] have examined the role of various factors contributing to vaccination coverage, and findings suggest that facilitators to vaccination include previous vaccination and provider recommendation, while barriers to vaccination include cost, consideration of adverse effects, and fear of contracting influenza from the vaccine.

Although costs are a barrier to vaccination, there is little research regarding how much individuals are generally willing to pay for influenza prevention and particularly for prevention in household members. Existing estimates of willingness to pay for influenza prevention focus on healthcare workers' or adults' willingness to pay for influenza prevention in hypothetical children.[17,18] The objectives of this study were to quantify employees' preferences, as measured by willingness to pay, to prevent influenza in themselves and in their child and adult household members and to examine factors associated with willingness to pay.

METHODS

Data and Study Design

Study data were collected as part of the Child and Household Influenza-Illness and Employee Function (CHIEF) study. The CHIEF study was a prospective observational cohort study conducted from November 2007 to April

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Take-Away Points

These findings are the first willingness-to-pay estimates of employees' preferences for influenza prevention among child and adult household members.

- Employees were willing to pay twice as much to prevent influenza among their children than among themselves or other adult household members; however, influenza vaccination rates among children were similar to those among employees and other adult household members. This suggests that extending employer-based influenza clinics to dependents may improve vaccination coverage.
- Notable barriers to vaccination include disagreement with national influenza vaccination recommendations and dislike of vaccinations.
- Targeted educational interventions regarding vaccination benefits may be necessary to improve vaccination coverage.

2008. Participants were employees of 3 large US employers, including a national retail chain, a transportation company, and a durable goods manufacturing company. Further identifying information for employers is restricted because of study confidentiality agreements.

The CHIEF study enrollment goal was 2400 employees. In October 2007, approximately 36,000 employees were mailed a letter offering a small monetary remuneration to participate in the surveys (also offered in Spanish and in paper form) and were provided with a Web address (URL) to a Web-based screener survey. The durable goods manufacturing company also disseminated information about the study through internal efforts. Therefore, the actual number of individuals who were aware of the study is unknown. Eligible employees were required to be covered under their employer's private health insurance plan and to have at least 1 child (≤17 years) who was covered under the same health insurance plan and lived in the employee's household for at least 4 days per week. This study was approved by the New England Institutional Review Board, and informed consent was obtained from all employees.

The study included a Web-based baseline survey and 6 Web-based monthly surveys. The baseline survey contained questions about household sociodemographics, health behaviors, comorbidities, and employee workplace characteristics. In each monthly survey and for each household member, employees reported the presence of acute respiratory illness and the specific symptoms comprised therein during the previous month. For all surveys, employees responded to all questions regarding themselves and each of their household members.

Outcome data used for this analysis came from the final survey. In the final survey, employees were presented with descriptions of influenza based on the actual duration and severity of influenza-like illness symptom constellations that were observed in the study cohort during the prior survey months.[19] Separate descriptions of influenza were presented for the employee, his or her child household members, and adult household members. Employees' preferences to prevent the described influenza for (1) themselves, (2) their child household members, and (3) their adult household members were measured using a previously fielded willingness-to-pay method that included dichotomous-choice double-bounded questions, followed by an open-ended question asking for the respondent's maximum willingness to pay; this maximum value was used for all analyses (Table 1), and the valuation technique is discussed in more detail by Prosser et al.[17] Personal and household member influenza vaccination status, reasons for vaccination among the vaccinated, and reasons for nonvaccination among the nonvaccinated were also captured in the final monthly study survey. Only employees who responded to every monthly survey and had nonmissing willingness-to-pay responses were included in this study.

Statistical Analysis

Factors associated with willingness to pay were examined using multivariate ordinary least squares regression analysis with the log of willingness to pay as the dependent variable. Log transforming the willingness-to-pay variable (which was skewed) allowed for approximation of normality of the error term. For each of 3 willingness-to-pay measures, the following 3 models were estimated: (1) all eligible employees were combined to examine the association between willingness to pay and sociodemographics, prior experience with influenza-like illness (since November 2007), comorbidities, and current vaccination status; (2) the sample was restricted to individuals who were vaccinated (or in the case of children and adults, ≥1 child and adult, respectively, in the employee's household were vaccinated) and incorporated additional variables regarding reported reasons for vaccination; and (3) the sample was restricted to individuals who were not vaccinated (or in the case of children and adults, no children and adults, respectively, in the employee's household were vaccinated) and incorporated additional variables regarding reported reasons for nonvaccination. Models were specified on the basis of a priori assumptions. Model output is presented as cost ratios, including the untransformed β coefficients from which the cost ratios were derived. For binary variables, the cost ratio is interpreted as the ratio of willingness to pay by employees for whom the binary indicator is 1 to willingness to pay by employees for whom the binary indicator is 0. For continuous variables, the cost ratio is interpreted as the incremental relative increase in willingness to pay for a 1-unit (1-U) increase in the variable. Statistical analyses

Table 1. Influenza-Like Illness Descriptions and Willingness-to-Pay Questions

	Influenza-Like Illness Descriptions
Children	An illness characterized by the abrupt onset of fever along with a cough, sore throat, runny nose, and chills that lasts about 7 days. The symptoms were the most severe for 4 days, and you took 1.5 days off to care for the sick child. About 60% of children with these symptoms will get medical care.
Other adult household members	An illness characterized by the abrupt onset of fever along with a cough, sore throat, and chills that lasts about 7 days. The symptoms were the most severe for 4 days, and you took 1.5 days off to care for the sick adult. About 45% of adults with these symptoms seek medical care.
Employees	An illness characterized by the abrupt onset of fever along with a cough, sore throat, and chills that lasts about 7 days. These symptoms were the most severe for 4 days, and as a consequence you missed work for 3 days. About 40% of people with these symptoms seek medical care. It takes 10 days after the first sign of your symptoms for you to "get back to normal."

Willingness-to-Pay Questions
1. Would you be willing to pay some amount of money to prevent (yourself/a child in your household/an adult in your household) from getting the illness just described?
2. Would you be willing to pay $100 to prevent (yourself/a child in your household/an adult in your household) from getting the illness just described?
3. Would you be willing to pay $200 to prevent (yourself/a child in your household/an adult in your household) from getting the illness just described?
4. Would you be willing to pay $400 to prevent (yourself/a child in your household/an adult in your household) from getting the illness just described?
5. What is the most you would be willing to pay?

were conducted using STATA release 9 (StataCorp LP, College Station, TX).

RESULTS

Sample Characteristics

During the time-limited enrollment period, 3686 employees completed the Web-based screening questionnaire. Of these employees, 2298 (62.3%) met the inclusion and exclusion criteria and completed the baseline survey. The percentage of employees who completed the survey each month ranged from 95.3% to 97.4% (data not shown). The final sample included 2006 employees (87.3% of 2298 initial responders) who had nonmissing willingness-to-pay responses in the final survey.

Table 2 summarizes the characteristics of employees and their household members. Employees were 31.3% female, their mean age was 41.7 years, 85.3% were of white race/ethnicity, 83.9% had attended at least some college, and the mean household size, including the employee, was 4.0 individuals. The demographics of employees included in the CHIEF study were comparable to US Census Bureau data on heads of households (also known as householders) 18 years or older.[20] In 2007, heads of households were 29.9% female, they had a mean age of 49.3 years, and 81.6% were of white race/ethnicity. However, employees in the CHIEF study were more educated than the general US heads of households (83.9% vs 56% had attended at least some college). Overall, 31.5% of employees, 27.5% of child household members, and 24.5% adult household members were vaccinated during the 2007-2008 vaccination season.

Willingness-to-Pay Estimates and Associated Factors

Employees' median (mean [SD]) willingness to pay for influenza prevention was $25 ($72 [$177]) for themselves (n = 2006) ($0 minimum and $400 maximum; 5th-95th percentiles, $0-$250), $25 ($82 [$280]) for their adult household members (n = 1835) ($0 minimum and $9999 maximum; 5th-95th percentiles, $0-$400), and $50 ($142 [$447]) for children (n = 2003) ($0 minimum and $9999 maximum; 5th-95th percentiles, $0-$500). The difference in willingness to pay for children versus for adults or themselves was significant (P <.01).

Table 3 gives willingness-to-pay estimates by the reported reasons for vaccination or nonvaccination. The most frequently reported reasons for vaccination were healthcare provider recommendations (for children) and a desire to protect family and household members (for employees and adult household members).

In the multivariate models in which all employees were combined to examine the factors associated with willingness to pay, the receipt of a vaccine in the current season was as-

Table 2. Characteristics of Employees and Their Household Members

Variable	Employees (n = 2006)	Children (n = 3799)	Other Adult Household Members (n = 2217)
Household size, mean	4.0	NA	NA
Household income, mode, $	50,000-75,000	NA	NA
Geographic region, %			
Northeast	25.2	NA	NA
South	38.8	NA	NA
Midwest	23.5	NA	NA
West	12.5	NA	NA
Age, mean, y	41.7	9.6	40.0
Female sex, %	31.3	48.4	69.5
Race/ethnicity, %			
White	85.3	81.7	85.9
Black	7.1	7.0	6.5
Multiple or other[a]	7.6	11.3	7.6
Hispanic descent, %	6.4	9.1	6.0
Education, %			
≤High school graduate	16.1	99.4	23.7
≥Some college	83.9	0.6	76.3
Physician visit within past year, %	61.4	77.3	60.6
Current smoker, %	11.8	0.0	13.0
High-risk comorbidity, %[b]	10.8	2.7	11.8
Pregnancy at baseline, %	0.4	—	1.6
Influenza vaccination, %[c]	31.5	27.5	24.5

NA indicates not applicable.
[a]Race/ethnicity categories were derived from the Centers for Disease Control and Prevention's Behavior Risk Factor Surveillance System.
[b]High-risk comorbidities were those considered to place individuals at high risk for influenza complications and included lung problems/asthma, heart problems, diabetic or other metabolic disorder, kidney disorder, weakened immune system, and sickle cell or other anemia.
[c]During the 2007-2008 winter season.

sociated with significantly higher willingness to pay for children, adult household members, and employees (P <.01 for all models). The full results of these models are available from the corresponding author.

Table 4 summarizes results for the subset models in which willingness to pay was examined for the aforementioned vaccinated groups listed in the "Methods" section. Of the various reported reasons for vaccination (holding other factors constant), access to free vaccination was associated with significantly lower willingness to pay in all models (P <.01 for all). Neither belief in vaccine efficacy nor experience of an influenza-like illness was significantly associated with willingness to pay.

Table 5 summarizes results for the subset models in which willingness to pay was examined for the aforementioned nonvaccinated groups listed in the "Methods" section. Household income of $50,000 or more was associated in all models with significantly higher willingness to pay (P <.01). Black race/ethnicity was associated with a significantly higher willingness to pay for personal prevention (P <.05). Among various reported reasons for nonvaccination, disagreement with national influenza vaccination recommendations was associated in all models with significantly lower willingness to pay (P <.01). In the model for children, cost and dislike of vaccinations were associated with significantly lower willingness to pay (P <.05). In the models for adult household members and employees, forgetting to be vaccinated was associated with significantly higher willingness to pay (P <.05). Consistent with the models among the vaccinated, neither belief in vaccine inefficacy nor experience of an influenza-like illness in the prior 6 months was significantly associated with willingness to pay.

Table 3. Employees' Willingness to Pay (WTP) for Prevention of Influenza-Like Illness by Reasons for Vaccination and Nonvaccination

	Children			Other Adult Household Members			Employees		
Variable	**No.**	**Mean WTP, $**	**Median WTP, $**	**No.**	**Mean WTP, $**	**Median WTP, $**	**No.**	**Mean WTP, $**	**Median WTP, $**
Reasons for vaccination[a]									
National recommendations say I should	108	322	50	117	74	30	353	77	35
Believe that influenza vaccinations are effective	208	232	50	295	82	35	177	88	35
Did not want to get sick from influenza	384	223	50	396	78	25	66	85	45
Believe that influenza vaccinations are part of a healthy lifestyle	133	219	50	180	96	40	385	85	40
Wanted to protect my family/household members	286	204	50	300	87	30	513	85	40
It was free	113	193	50	190	66	25	310	87	40
My physician or healthcare provider recommended it	330	190	50	167	84	35	390	89	40
A family member or friend recommended it	73	131	50	52	96	40	156	88	40
It was convenient	99	129	50	173	73	30	251	97	40
Reasons for nonvaccination[b]									
It cost too much	80	49	25	102	38	25	82	29	20
Allergy to influenza vaccines	11	63	50	17	58	20	15	36	25
It was inconvenient	190	85	50	227	69	25	210	49	25
Do not like vaccinations	162	97	50	153	71	25	133	56	25
The vaccines are not effective	136	98	50	169	65	25	198	55	25
Forgot	93	105	50	123	87	25	121	54	25
Do not agree with national recommendations	192	109	30	219	61	20	260	52	20
Do not like needles	265	113	50	133	53	20	136	78	25
Concern about adverse effects	335	118	50	313	82	25	330	53	25
Was not in high-priority group	450	118	50	452	66	25	495	71	25
Could not find a place that had vaccine	18	195	50	17	64	50	15	51	40

[a]For children, responses were among employees with at least 1 child in the household who was vaccinated for the 2007-2008 season; for other adult household members, responses were among employees with at least 1 other adult in the household who was vaccinated for the 2007-2008 season; for employees, responses were among employees who were vaccinated for the 2007-2008 season. Reasons for vaccination were specific to the children, other adult household members, and employees.

[b]For children, responses were among employees with no children in the household who were vaccinated for the 2007-2008 season; for other adult household members, responses were among employees with no other adults in the household who were vaccinated for the 2007-2008 season; for employees, responses were among employees who were not vaccinated for the 2007-2008 season. Reasons for nonvaccination were specific to the children, other adult household members, and employees.

DISCUSSION

Employee preferences for preventing influenza, as measured by willingness to pay, can assist decision makers in optimizing vaccine strategies. These findings are the first willingness-to-pay–based estimates of employees' preferences for influenza prevention among their child and adult household members to date.

As the first and most important step in protecting against seasonal influenza, the CDC recommends that all healthy individuals should be vaccinated against the influenza virus. We found that employees were willing to pay twice as much to prevent influenza in their children than in themselves or other adult household members; however, children were vaccinated against influenza at rates approximately equal to the rates in employees and other adult household members, and each of these rates was below the *Healthy People 2010* goals.[21] Our findings that employees expressed a higher willingness to pay to prevent influenza in children are consistent with previous evidence that individuals valued reducing health risk in children differently than reducing similar risk in adults.[22]

Our estimates of willingness to pay for influenza prevention demonstrate that most employees' willingness to pay for influenza prevention in themselves and in their adult house-

Table 4. Factors Associated With Willingness to Pay (WTP) Among Vaccinated Groups[a]

	WTP for Children			WTP for Other Adult Household Members			WTP for Employees		
Variable	**Cost Ratio**	**β Level**	***P***	**Cost Ratio**	**β Level**	***P***	**Cost Ratio**	**β Level**	***P***
Male sex	1.016	.016	.92	0.893	–.113	.56	0.739	–.303	**.02**
Age	0.974	–.026	**.01**	0.996	–.004	.75	0.990	–.010	.26
Household income ≥$50,000	1.055	.053	.76	1.411	.344	.18	1.158	.147	.37
Race/ethnicity (reference is white race/ ethnicity)									
Black	1.265	.235	.42	0.698	–.360	.36	1.355	.304	.23
Multiple or other	1.161	.149	.54	0.854	–.158	.63	1.189	.174	.56
Geographic region (reference is South)									
Northeast	0.827	–.189	.27	0.627	–.468	**.03**	1.014	.014	.92
Midwest	0.804	–.219	.21	0.621	–.476	**.02**	0.850	–.162	.28
West	0.623	–.473	**.03**	0.726	–.321	.27	0.824	–.194	.36
Primary caregiver if child is sick	1.043	.042	.77	1.030	.029	.87	1.126	.119	.33
Flexible work arrangements	0.927	–.076	.58	1.240	.215	.20	0.995	–.005	.97
Days of paid time off	1.011	.011	.79	0.965	–.035	.49	0.963	–.038	.29
High-risk comorbidity[b]									
Employee	1.255	.227	.19	1.651	.501	.01	1.117	.111	.43
Child	1.075	.072	.64	0.942	–.059	.77	1.018	.018	.90
Other adult household member	0.781	–.247	.13	1.213	.193	.30	0.934	–.069	.64
Influenza-like illness in previous 6 months[c]									
Employee	1.192	.175	.21	0.757	–.279	.11	1.364	.310	**.01**
Child	0.844	–.170	.25	0.886	–.121	.49	0.769	–.263	**.03**
Other adult household member	0.906	–.098	.50	0.913	–.091	.61	0.871	–.138	.27
Reasons for vaccination[d]									
Did not want to get sick from influenza	1.193	.176	.27	0.920	–.083	.71	1.138	.130	.42
Wanted to protect my family/household members	1.149	.139	.37	0.835	–.180	.34	1.048	.047	.73
Believe that influenza vaccinations are effective	1.005	.005	.98	1.481	.393	.07	1.112	.106	.48
Believe that influenza vaccinations are part of a healthy lifestyle	0.917	–.087	.69	1.085	.082	.70	1.133	.125	.40
It was convenient	1.230	.207	.30	1.060	.059	.77	1.254	.226	.11
It was free	0.622	–.475	**.02**	0.584	–.537	**<.01**	0.702	–.354	**.01**
National recommendations say I should	1.359	.306	.11	0.997	–.003	.99	0.933	–.069	.65
My physician or healthcare provider recommended it	0.839	–.175	.22	1.057	.056	.77	0.996	–.004	.98
A family member or friend recommended it	0.885	–.123	.55	1.168	.155	.58	1.003	.003	.99
Constant	—	5.162	**<.01**	—	3.615	**<.01**	—	4.100	**<.01**
No. of observations	—	585	—	—	496	—	—	629	—
R^2 coefficient	—	0.053	—	—	0.073	—	—	0.055	—

[a]Outcome is the log of WTP; positive (negative) coefficient sign is indicative of higher (lower) WTP. For binary variables, the cost ratio is interpreted as the ratio of WTP in employees for whom the binary indicator is 1 to WTP in employees for whom the binary indicator is 0; for continuous variables, the cost ratio is interpreted as the incremental relative increase in WTP for a 1-unit increase in the variable. Boldfaced *P* values indicate statistical significance.
[b]High-risk comorbidities were those considered to place individuals at high risk for influenza complications and included lung problems/asthma, heart problems, diabetic or other metabolic disorder, kidney disorder, weakened immune system, and sickle cell or other anemia.
[c]November 2007 to April 2008.
[d]In the model of WTP for influenza-like illness prevention in children, the subset was employees with at least 1 child in the household who was vaccinated for the 2007-2008 season; in the model of WTP for influenza-like illness prevention in other adult household members, the subset was employees with at least 1 other adult in the household who was vaccinated for the 2007-2008 season; in the model of WTP for personal influenza-like illness prevention, the subset was employees who were vaccinated for the 2007-2008 season. Reasons for vaccination were specific to the children, other adult household members, and employees for the respective models.

Table 5. Factors Associated With Willingness to Pay (WTP) Among Nonvaccinated Groups[a]

	WTP for Children			WTP for Other Adult Household Members			WTP for Employees		
Variable	**Cost Ratio**	**β Level**	***P***	**Cost Ratio**	**β Level**	***P***	**Cost Ratio**	**β Level**	***P***
Male sex	0.864	–.146	.17	0.642	–.443	**<.01**	0.851	–.161	.17
Age	1.002	.002	.80	1.005	.005	.57	0.997	–.003	.70
Household income ≥$50,000	1.429	.357	**<.01**	1.508	.411	**<.01**	1.567	.449	**<.01**
Race/ethnicity (reference is white race/ethnicity)									
Black	1.225	.203	.26	1.427	.355	.09	1.614	.478	**.01**
Multiple or other	0.856	–.156	.50	0.713	–.338	.10	0.931	–.072	.68
Geographic region (reference is South)									
Northeast	0.922	–.082	.51	0.887	–.119	.40	0.758	–.277	**.03**
Midwest	0.802	–.221	.07	0.791	–.234	.10	0.709	–.344	**<.01**
West	0.714	–.337	**.03**	0.738	–.304	.08	0.748	–.291	.06
Primary caregiver if child is sick	1.216	.196	.06	0.931	–.072	.55	1.231	.208	.05
Flexible work arrangements	1.020	.020	.84	0.905	–.100	.36	1.023	.023	.82
Days of paid time off	0.994	–.006	.83	1.015	.015	.65	1.028	.0275	.34
High-risk comorbidity[b]									
Employee	1.102	.098	.44	1.179	.165	.27	0.972	–.029	.84
Child	1.000	.0004	>.99	1.003	.003	.99	1.131	.123	.35
Other adult household member	0.973	–.027	.82	0.888	–.119	.42	0.923	–.080	.53
Influenza-like illness in previous 6 months[c]									
Employee	0.996	–.004	.97	0.961	–.039	.73	0.926	–.077	.46
Child	1.032	.032	.75	1.022	.021	.86	1.148	.138	.19
Other adult household member	1.104	.099	.34	1.071	.069	.56	1.065	.063	.56
Reasons for nonvaccination[d]									
Do not like needles	1.038	.038	.77	0.789	–.238	.23	0.842	–.172	.29
Do not like vaccinations	0.712	–.339	.03	0.921	–.082	.67	0.896	–.109	.52
Concern about adverse effects	1.070	.068	.56	1.126	.119	.40	0.908	–.096	.42
Allergy to influenza vaccines	0.800	–.223	.71	1.336	.290	.55	1.028	.027	.95
It was inconvenient	1.011	.011	.94	1.261	.232	.13	1.067	.065	.63
It cost too much	0.636	–.453	**.03**	0.934	–.068	.75	0.832	–.184	.37
The vaccines are not effective	0.975	–.025	.88	0.969	–.031	.86	0.956	–.046	.74
Was not in high-priority group	0.995	–.005	.96	0.986	–.015	.90	1.222	.201	.06
Do not agree with national recommendations	0.565	–.571	**<.01**	0.574	–.555	**<.01**	0.613	–.490	**<.01**
Forgot	1.276	.244	.24	1.582	.459	**.02**	1.439	.364	**.04**
Could not find a place that had vaccine	1.601	.471	.32	0.834	–.181	.71	0.984	–.016	.97
Constant	—	.459	**<.01**	—	2.648	**<.01**	—	2.729	**<.01**
No. of observations	—	1406	—	—	1327	—	—	1250	—
R^2 coefficient	—	0.046	—	—	0.054	—	—	0.065	—

[a]Outcome is the log of WTP; positive (negative) coefficient sign is indicative of higher (lower) WTP. For binary variables, the cost ratio is interpreted as the ratio of WTP in employees for whom the binary indicator is 1 to WTP in employees for whom the binary indicator is 0; for continuous variables, the cost ratio is interpreted as the incremental relative increase in WTP for a 1-unit increase in the variable. Boldfaced *P* values indicate statistical significance.
[b]High-risk comorbidities were those considered to place individuals at high risk for influenza complications and included lung problems/asthma, heart problems, diabetic or other metabolic disorder, kidney disorder, weakened immune system, and sickle cell or other anemia.
[c]November 2007 to April 2008.
[d]In the model of WTP for influenza-like illness prevention in children, the subset was employees with no children in the household who were vaccinated for the 2007-2008 season; in the model of WTP for influenza-like illness prevention in other adult household members, the subset was employees with no other adults in the household who were vaccinated for the 2007-2008 season; in the model of WTP for personal influenza-like illness prevention, the subset was employees who were not vaccinated for the 2007-2008 season. Reasons for nonvaccination were specific to the children, other adult household members, and employees for the respective models.

hold members was in the range of the combined cost of influenza vaccination and administration. There are additional costs associated with vaccination, including transportation and potential loss of time from work or usual activities.[23-25] The approximately equal rates of vaccination across employees, children, and adults suggest that such costs or other barriers to vaccination have an important role in the decision to refrain from vaccination, and employees may face comparatively lower barriers when seeking vaccination for themselves compared with seeking vaccination for their children. A potential strategy to reduce the hidden cost of vaccination and to improve vaccination coverage for children may be to extend employer-based influenza clinics to dependents.

Prior studies have cited several factors that influence such a decision to refrain from vaccination. Mayo and Cobler[16] reported that among hospitalized patients the most frequently cited reasons for nonvaccination were consideration of adverse effects and fear of contracting influenza from the vaccine. Logan[15] recently examined the role of disparities in nonvaccination and cited cost, insurance, language barriers, underestimation of influenza risks, misperceptions of influenza vaccination, and mistrust of the healthcare system as factors.

Among our employed, insured, and predominantly white sample, employees who reported cost as a reason for nonvaccination among their children had significantly lower willingness to pay for influenza prevention; however, cost was not found to be a factor for personal influenza prevention. This may be due in part to the fact that some employees had access to at-work vaccination programs, which frequently provide coverage to the employee at no charge but not to their dependents. Given employees' stronger preference to prevent influenza in their child household members, the potential to capture societal benefits and improve influenza vaccine coverage may exist through the extension of employer-based influenza clinics to dependents.

Among the nonvaccinated, disagreement with national influenza vaccination recommendations was associated with significantly lower willingness to pay for influenza prevention in employees and in their child and adult household members. In terms of employees' willingness to pay for influenza prevention in children, employees who had no vaccinated children and who reported a dislike of vaccinations also had significantly lower willingness to pay for prevention. The association of both of these factors with employees' willingness to pay for influenza prevention suggests potential misperceptions of influenza vaccination. This finding indicates that targeted educational interventions regarding the benefits of vaccination may be necessary to improve vaccination coverage.

Employees reporting that they or their household members were vaccinated against influenza because it was free expressed a significantly lower willingness to pay than those not reporting such a motivation. One potential explanation for this finding is that free vaccination programs are successful at attracting individuals who otherwise place a low value on influenza prevention, a key goal of such programs.

The findings that influenza-like illness in the previous 6 months, belief in vaccine efficacy, and perception of vaccine inefficacy had nonsignificant associations with willingness to pay are notable and unexplained. Furthermore, among employees who were nonvaccinated, black employees expressed a higher willingness to pay for personal influenza prevention. This also suggests the potential value of targeted educational interventions for certain subgroups.

The influenza vaccination rate found in the CHIEF study is consistent with other self-reported survey studies conducted around this period. During the 2007-2008 vaccination season, vaccination rates for children aged 6 to 59 months ranged between 22% (cohort aged 24-59 months) and 40.8% (cohort aged 6-23 months).[26] Recently, a 24% vaccination rate was reported in children aged 6 months to 17 years.[27] In adults, the vaccination rate found in the CHIEF study was higher than what is reported by the CDC. For 2007, the CDC estimated that 17% of adults aged 18 to 49 years and 36% of adults aged 50 to 64 years received influenza vaccination.[28] The difference between the CHIEF study vaccination rate and other reported vaccination rates may reflect that our study sample represented employed individuals with children, who could differ in their propensity for vaccination compared with the populations from which the CDC and other researchers based their estimates.

Our estimates of willingness to pay differ from estimates previously reported. Prosser and colleagues[17] examined adults' willingness to pay to prevent uncomplicated influenza in a 1-year-old child and in a 14-year-old child. They found that willingness to pay decreased with increasing age, averaging $469 for a 1-year-old child and $288 for a 14-year-old child. Our estimates of willingness to pay for prevention of influenza in children (mean age, 9.7 years) are lower at $142. Lee and colleagues[29] estimated that individuals on average were willing to pay $15.49 (2001 US dollars) for a day of relief from influenza symptoms based on a sample of 210 patients seeking primary care at a family practice clinic in North Carolina. Our scenarios presented descriptions of influenza in which the individuals were ill for approximately 7 days; if employees valued each day of symptom relief equally, then our estimates are also somewhat lower than those by Lee and colleagues. Finally, Steiner and colleagues[18] conducted a survey of willingness to pay for vaccination among 1718 employees of a healthcare facility and found a mean willingness to pay for vaccination of $10.47. A distinguishing characteristic of that study was that the willingness to pay was elicited for vaccination rather than for prevention of symptoms.

One of the major criticisms of estimating willingness to pay through surveys is that this may result in a poor estimate of the actual willingness to pay.[30] Prior research has shown that respondents commonly express a higher willingness to pay in hypothetical situations than in actual practice, a phenomenon referred to as hypothetical bias.[31,32] Although there are a limited number of published field studies from the health-related sector, the findings are mixed on the level of overestimation of stated willingness to pay compared with what subjects actually pay. In studies[33-36] estimating the value for insecticide-treated nets, disease management services, and bottled water for infant formula, overestimation was reported to be as high as 4-fold. For a pharmacist asthma management program, subjects stated a willingness to pay of $29.23, while actual payments were $8.97, for example.[33] In contrast, studies[37,38] that examined purchase of blood testing devices and insecticide-treated nets found no evidence of hypothetical bias.

Although there are multiple reasons for overestimation in willingness to pay, a plausible explanation for hypothetical bias is the lack of subjects' engagement in acquiring the non–market good being tested through surveys.[39] To address this, we attempted to decrease the hypothetical nature of the question by using descriptions of influenza that reflected the average influenza-like symptoms as experienced by the cohort under study. While previous estimates of individuals' willingness to pay for prevention of (uncomplicated) influenza in children have partially relied on reports from respondents without children who valued their willingness to pay in relation to a hypothetical child,[17] our study's estimated willingness to pay for prevention of influenza in children came from a sample of employees in which all respondents had children. Although this unique feature of the design and valuation technique in the present study may theoretically reduce bias, the effect of eliminating these 2 hypothetical elements on potential hypothetical bias is unknown.

This study was subject to limitations. The data came from a nonrandom (convenience) sample and may not be generalizable to all employed individuals in the United States. As with any survey-based study, our data are subject to bias inherent in self-report surveys. Approximately 13% of the eligible study sample had not completed all monthly surveys or had not reported other information required for this analysis. We used 1 of many potential estimation methods, which is reflected in part by the differences between our estimates of willingness to pay and those reported in previous literature.[17,18,31,40] We measured willingness to pay for influenza prevention during the 2007-2008 vaccination season, and the elevated public awareness regarding influenza resulting from the influenza (AH1N1) pandemic may have altered individuals' willingness to pay for influenza prevention; therefore, our estimates may not reflect individuals' current preferences. As already noted, we cannot eliminate the possibility that our estimates are subject to hypothetical bias; thus, the stated willingness-to-pay values estimated from our study may be an overestimation of the actual amount that parents may be willing to pay to prevent influenza, which is a potential explanation for the incongruence between vaccination rates and the median levels of willingness to pay for influenza prevention.

This study has notable strengths. Although drawn from a convenience sample, respondents came from 3 large diverse US employers of differing industries, providing broad sociodemographic and geographic coverage. Participants had a wide array of educational attainment and income and represented all geographic regions of the United States. Furthermore, with more than 2000 respondents, the study sample was the largest to date that has been used for appraisal of willingness to pay and for examination of vaccination attitudes.

In conclusion, these findings are the first estimates to date based on willingness to pay relative to employees' preferences for influenza prevention in their child and adult household members. Employees were willing to pay twice as much to prevent influenza in their children than in themselves or other adult household members; however, children were vaccinated against influenza at rates approximately equal to the rates in employees and other adult household members. Modifiable barriers to vaccination persist. Vaccination rates may be improved through targeted educational interventions regarding the benefits of vaccination and through extension of employer-based influenza clinics to dependents.

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