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Trust in medical organizations predicts pandemic (H1N1) 2009 vaccination behavior and perceived efficacy of protection measures in the Swiss public

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Abstract Following the recent avian influenza and pandemic (H1N1) 2009 outbreaks, public trust in medical and political authorities is emerging as a new predictor of compliance with officially recommended protection measures. In a two-wave longitudinal survey of adults in French-speaking Switzerland, trust in medical organizations longitudinally predicted actual vaccination status 6 months later, during the pandemic (H1N1) 2009 vaccination campaign. No other variables explained significant amounts of variance. Trust in medical organizations also predicted perceived efficacy of officially recommended protection measures (getting vaccinated, washing hands, wearing a mask, sneezing into the elbow), as did beliefs about health issues (perceived vulnerability to disease, threat perceptions). These findings show that in the case of emerging infectious diseases, actual behavior and perceived efficacy of protection measures may have different antecedents. Moreover, they suggest that public trust is a crucial determinant of vaccination behavior and underscore the practical importance of managing trust in disease prevention campaigns.

Keywords Efficacy perception · Health beliefs · Official recommendations · Pandemic (H1N1) 2009 · Trust in medical organizations · Vaccination behavior

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Since 2005, the world has experienced two major influenza outbreaks, H5N1 among birds in 2005–2006, and pandemic H1N1 among humans in 2009. The latter outbreak propagated worldwide, prompting the World Health Organization to declare the first influenza pandemic of the twenty-first century. In each case, medical authorities and governments have taken the threat very seriously, initiating national and internationally coordinated plans to manage the outbreaks. Important components of these plans involved ordering and stockpiling doses of vaccine and disseminating recommendations about appropriate protective measures among the public, as well as launching vaccination campaigns. In the end, the consequences of these outbreaks were not as serious as feared. Related to this outcome is an emerging perception on the part of the public that the threat was overestimated [1], perhaps even deliberately [2]. For example, in the wake of the worldwide pandemic (H1N1) 2009 vaccination campaigns, charges of conflict of interest have been leveled at the World Health Organization (WHO) for its decisions which triggered the ordering of huge quantities of subsequently unused vaccine [3]. These events reflect a decrease in public trust in medical and political authorities which could have important implications for future public compliance with official recommendations [4]. The decrease of public trust is particularly severe in the case of skepticism about the efficacy of vaccination [5]. Public skepticism about vaccination efficacy may be based on prior crises like the 1976 swine flu vaccination campaign [6], which resulted in unanticipated side effects. The widespread but erroneous public beliefs in the harmfulness of the MMF vaccine also may have played a role in decreasing trust [7].

Concerns over the role of trust in managing infectious disease crises are particularly pressing if trust affects perceptions of the risks involved in vaccination decisions, and, ultimately, behavior. Research on this issue is lacking. Although lay perceptions affect how the public reacts to and applies recommendations [8–10], up to now the impact of trust has not been studied. Moreover, many studies also measure intentions or perceived efficacy as proxies for actual behavior or use cross-sectional designs [10–12].

In a longitudinal study conducted in Switzerland, we assessed the impact of sociodemographic factors, beliefs about health issues and about influenza and trust in institutions on actual pandemic (H1N1) 2009 vaccination status and on the perceived efficacy of official pandemic (H1N1) 2009 recommendations. Our key result is the demonstration of the causal effect of trust on vaccination behavior: Trust in medical organizations measured among Swiss residents in the Summer of 2009 is the only variable that predicts actual vaccination status during the Winter 2009 pandemic (H1N1) 2009 vaccination campaign. Moreover, perceived efficacy is affected by different predictors than actual vaccination status.

Methods

Participants and data collection

We started out to conducted a two-wave longitudinal survey of adults' ($N = 601$) perceptions of H5N1 in French-speaking Switzerland. For Wave 1, 2,400 adults were contacted between March and June 2009. They were randomly selected from a database of 432,983 addresses according to gender, age (18–39, 40–65, above 65), and residential area (rural vs. urban). The initial outbreak of pandemic (H1N1) 2009 serendipitously occurred during the data collection. We seized this unique opportunity to measure, a year later, respondents' actual pandemic (H1N1) 2009 vaccination status, and their perception of efficacy of recommended protection measures (Wave 2). In Switzerland, the first cases of pandemic (H1N1) were detected at the end of April 2009. Cases peaked in December 2009, at the same time the vaccination campaign was launched [13].

Our final sample included 340 women and 261 men (age: $M = 46.21$, SD = 15.79; 63.26% of the 950 Wave 1 respondents; response rate at Wave 1: 39.60% with one reminder). Except for residential area[1], we obtained a sample close to the general population of Switzerland according to the 2008 census (Table 1). Respondents received CHF 20 for participation. Because pandemic (H1N1) 2009 started during the data collection, we distinguished surveys received before and after the outbreak as a control variable (*H1N1 Outbreak*).

Measures

The Wave 1 questionnaire was adapted from a previous survey about avian influenza [14]. To homogenize response format, we mainly used Likert scales ranging from 1 to 5 and computed mean scores. As predictors we used demographic variables (age, gender, residential area, education, income, and number of children; see Table 1 for details). We also included variables concerning beliefs and perceptions about health issues: subjective health (1 item; 1 = *very bad* to 5 = *very good*), perceived vulnerability to disease (PVD) [15] (8 items; 1 = *low* to 5 = *high*; alpha = .75), perceived avian influenza threat (1 item; 1 = *not a threat* to 5 = *a real threat*), and knowledge about avian influenza [16] (5 items; 1 = *poor* to 5 = *good*). We measured trust in governments (3 items about the Swiss government, the European Union and governments of countries affected by influenza; 1 = *low* to 5 = *high*; alpha = .69), and trust in medical organizations (3 items about the World Health Organization, medical and pharmaceutical organizations; 1 = *low* to 5 = *high*; alpha = .75). Finally, we controlled for contextual variables: the pandemic (H1N1) 2009 outbreak (−.50 = *survey received before outbreak*, .50 = *survey received after*), concerns with societal problems (unemployment, financial crisis, alpha = .77; $M = 3.77$, SD = .92, scale ranging from 1 = *low* to 5 = *high*), and for ideological attitudes known to be related to trust in institutions: political attitudes (1 item; 1 = *left* to 7 = *right;* $M = 3.77$, SD = 1.36), religious attitudes (1 item; 1 = *weak religious belief* to 5 = *strong religious belief;* $M = 2.68$, SD = 1.19) and national identification (3 items; 1 = *low* to 5 = *high*; alpha = .86, $M = 3.75$, SD = .93).

The dependent variables were measured at Wave 2. Participants indicated their vaccination status (1 item: 0 = *not vaccinated*, 1 = *vaccinated*). The proportion of vaccinated participants was 17.8%, against approximately 15% in the Swiss population [17]. Participants estimated the efficacy of four officially recommended protection measures (1 = *not effective at all*, 5 = *totally effective*): getting vaccinated, washing hands, wearing a mask, and sneezing in the elbow[2]. Half of the participants estimated the efficacy of these measures for avian influenza and half for pandemic (H1N1) influenza. Because mean estimations did not differ between the two groups (all $Fs < .22$, all

[1] We intentionally sampled participants to obtain equal representation of residential areas.

[2] Repeated sample *t*-tests performed on the means indicated that vaccination was seen as the least efficient recommendation (lower difference: t [588] = -5.28, $P < .001$). Washing hands was seen as the most efficient one (lower difference: t [588] = 19.21, $P < .001$).

Table 1 Main demographic characteristics of the general Swiss population and of the sample

	Swiss Population (OFS, 2008)	Wave 1 $N = 950$	Wave 2 $N = 601$
Age			
20–39 years (%)	26.80	38.20	23.50
40–64 years (%)	35.40	46.20	59.20
65 years and more (%)	16.60	14.50	16.50
Sex			
Male (%)	49.16	45.00	43.4
Female (%)	50.84	55.00	56.6
Residential area			
Rural (%)	26.00	54.90	54.70
Urban (%)	74.00	46.10	45.30
Education			
Secondary (%)	13.00	12.10	12.20
High school (%)	53.00	55.30	57.10
College/university degree (%)	34.00	32.60	30.70
Monthly income*			
0–3,500 (%)	17.00	17.30	18.00
3,501–9,500 (%)	64.90	62.70	63.20
> 9,500 (%)	18.10	16.80	16.00
Mean number of children	1.48	.97	.97
Proportion of sample complying with pandemic (H1N1) 2009 vaccination recommendations (%)	15.00	–	17.80

Population data are taken from the 2008 census conducted by the Swiss Federal Statistical Office, except for H1N1 vaccination rate. * Income is indicated in Swiss francs (CHF)

ps > .64), we aggregated the data. Descriptive data and correlations between variables appear in Table 2.

Statistical analyses

First, a logistic hierarchical regression was performed on vaccination status as dependent variable with predictor variables entered in three blocks. Block 1 included demographic variables (age, gender, residential area, education, income, and number of children). Beliefs about health issues and about influenza (subjective health, perceived vulnerability to disease, perceived personal avian influenza threat, knowledge about influenza) were entered in Block 2. Finally, in Block 3, we introduced the two variables measuring trust in governments and trust in medical organizations.

The same three blocks were entered as predictors in four hierarchical linear regressions conducted on perceived efficacy of the four protection measures (vaccination, washing hands, wearing a mask, sneezing into the elbow) with the only difference being that vaccination status was also entered as a predictor in the second block.

For all the regressions, we initially controlled for contextual variables (concerns with unemployment, concerns with the financial crisis and pandemic (H1N1) 2009 outbreak) and ideological attitudes (political orientation, religiosity and national identity) by entering them in a first block. As these variables were not correlated with our predictors and did not impact the model, they were subsequently removed from the analyses. Multicollinearity was also controlled for: Although both trust variables are correlated, tolerance is acceptable (>.50). Moreover, the effect of trust in medical organizations on vaccination status remains stable when entered as the only predictor, thus suggesting that it is independent of the correlation with trust in governments.

Results

Vaccination behavior

Wave 2 vaccination status was regressed on Wave 1 predictors which were entered into the three-block hierarchical logistic regression (Table 3). The amount of variance explained by the first block (demographic variables: age, gender, residential area, education, income, children) was not significant: $R^2 = .02$, $\chi^2\,(6, N = 601) = 5.19$, $P = .52$. None of the variables significantly impacted vaccination status. Including beliefs about health issues (subjective health, perceived vulnerability to disease, perceived personal avian influenza threat, perceived seasonal influenza vaccination efficacy, knowledge about influenza) in Block 2 did not improve the model : $R^2 = .04$, χ^2 (10, $N = 601) = 12.11$, $P = .28$; χ^2 (4, $N = 601) = 6.92$, $P = .14$. At this point, then, none of the variables significantly predicted vaccination status. In Block 3, we introduced the two variables measuring trust in governments and trust in medical organizations, which improved the model: $R^2 = .09$, χ^2 (12, $N = 601) = 29.99$, $P = .003$; χ^2 (2, $N = 601) = 17.88$, $P < .001$. Only trust in medical organizations significantly predicted vaccination status: $B = .76$, SE $= .21$, $P < .001$. The odds ratio indicated that a one-point increase (on a five-point scale) of trust in medical organizations made vaccination 2.14 times more likely.

Perceived efficacy of officially recommended protection measures

For the regressions predicting perceived efficacy, each block entered in the analyses improved the models (model parameters and estimates of significant predictors are presented in Table 3). In other words, whereas for vaccination

Table 2 Means, Standard Deviations and Correlations for Study Variables

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Age	46.22	15.79																	
2. Gender	1.43	.50	.01																
3. Residential area	1.55	.50	.01	−.02															
4. Education	2.85	1.37	−.14**	−.08	−.22**														
5. Income	1.99	.62	.03	.09*	−.02	.29**													
6. Children	.97	1.23	−.04	−.08	−.15**	−.09*	.14**												
7. Subjective health	4.10	.73	−.21**	.05	.00	.03	.14**	−.01											
8.Perceived vulnerability to disease	2.29	.75	.10*	−.13**	−.07	−.10*	−.10*	−.09*	−.22**										
9. Perceived avian influenza threat	2.63	1.20	.08	−.05	−.09*	−.12**	−.02	−.10*	−.17**	.24**									
10. Knowledge about avian influenza	2.72	1.13	.09*	.07	.04	.06	.07	.02	.04	−.03	−.03								
11.Trust in governments	2.98	.78	−.10*	−.06	−.10*	.02	−.01	−.05	.06	.05	.00	−.06							
12. Trust in medical organizations	3.53	.78	−.05	−.12**	−.01	−.02	−.03	.04	−.01	.11**	.04	−.05	.63**						
13. Vaccination status	.18	.38	.07	−.06	−.02	.01	.03	.06	−.12**	.07	.07	.03	.07	.15**					
14. Perceived efficacy of vaccination	2.95	1.23	.05	.04	−.07	.08	.08	.04	−.14**	.03	.13**	.00	.18**	.25**	.36**				
15. Perceived efficacy of washing hands	4.35	.86	.10*	−.10*	−.12**	.06	.02	−.04	−.02	.24**	.13**	.06	12**	.18**	.04	.19**			
16. Perceived efficacy of wearing a mask	3.41	1.13	−.11**	−.02	−.09*	.11*	.07	.04	.00	.11**	.17**	.00	.10*	.15**	.09*	.28**	.28**		
17. Perceived efficacy of sneezing into elbow	3.28	1.30	.09*	−.11**	−.06	.06	.03	.03	−.03	.16**	.08	.05	.14**	.15**	.04	.21**	.35**	.25**	

* $P < .05$; ** $P < .01$; gender: 1 = female, 2 = male; residential area: 1 = urban, 2 = rural; vaccination status: 0 = not vaccinated, 1 = vaccinated

Table 3 Model parameters and estimates of significant predictors of vaccination behavior and perceived efficacy of vaccination, washing hands, wearing a mask, and sneezing into the elbow

	B	SE	R^2	R^2 change
Model 1				
Predictors of vaccination behavior			.02	
(None)	–	–		
Predictors of perceived efficacy of vaccination			.02	
(None)	–	–		
Predictors of perceived efficacy of washing hands			.03*	
Age	.01*	.002		
Gender	−.18*	.07		
Predictors of perceived efficacy of wearing a mask			.02*	
Residential area	−.23*	.10		
Predictors of perceived efficacy of sneezing into elbow			.03**	
Age	.01**	.004		
Gender	−.26**	.11		
Model 2				
Predictors of vaccination behavior			.04	.02
(None)	–	–		
Predictors of perceived efficacy of vaccination			.17***	.15***
Gender	.20*	.10		
Perceived health state	−.16*	.07		
Perceived threat	.10*	.04		
Pandemic (H1N1) 2009 vaccination	1.12***	.13		
Predictors of perceived efficacy of washing hands			.10***	.07***
Perceived vulnerability to disease	.28***	.05		
Predictors of perceived efficacy of wearing a mask			.07***	.04***
Age	−.01*	.003		
Education	.08*	.04		
Perceived vulnerability to disease	.14*	.07		
Perceived threat	.15***	.04		
Predictors of perceived efficacy of sneezing into elbow			.06**	.03*
Age	.01*	.004		
Gender	−.23*	.11		
Education	.09*	.04		
Perceived vulnerability to disease	.23**	.08		
Model 3				
Predictors of vaccination behavior			.07**	.03***
Trust in medical organizations	.76***	.21		
Predictors of perceived efficacy of vaccination			.21***	.04***
Gender	.24*	.10		
Perceived health state	−.16*	.07		
Perceived threat	.10*	.04		
Pandemic (H1N1) 2009 vaccination	1.01***	.13		
Trust in medical organizations	.30***	.08		
Predictors of perceived efficacy of washing hands			.13***	.03***
Perceived vulnerability to disease	.26***	.05		
Trust in medical organizations	.17**	.06		
Predictors of perceived efficacy of wearing a mask			.09***	.02**

Table 3 continued

	B	SE	R^2	R^2 change
Education	.08*	.04		
Perceived threat	.15***	.04		
Trust in medical organizations	.22**	.08		
Predictors of perceived efficacy of sneezing into elbow			.08***	.02**
Age	.01*	.004		
Education	.09*	.04		
Perceived vulnerability to disease	.20**	.08		

* $P < .05$; ** $P < .01$; *** $P < .001$

behaviors, only trust in medical organizations explained a significant part of variance, for perceived efficacy, the model benefits from both beliefs about health issues and trust in medical organizations.

Significant predictors of perceived efficacy of getting vaccinated were: gender (men rated vaccination as more effective than women), subjective health (participants subjectively in good health rated vaccination as less effective than participants subjectively in bad health), perceived threat (participants perceiving higher threat rated vaccination more effective than those perceiving lower threat), vaccination status (people who got vaccinated rated vaccination as more effective than those who didn't) and trust in medical organizations (trust increased perceived efficacy of vaccination).

Significant predictors of perceived efficacy of washing hands were perceived vulnerability to disease (participants feeling vulnerable rated washing hands as more effective those who felt less vulnerable), and trust in medical organizations (trust increased perceived efficacy of washing hands).

Significant predictors of perceived efficacy of wearing a mask were education (participants with a higher educational level rated masks as more effective than people with a lower educational level), perceived threat (the more people felt threatened by the disease, the more they ascribed efficacy to masks), and trust in medical organizations.

Significant predictors of perceived efficacy of sneezing in the elbow were age (older people rated sneezing in the elbow as more effective than younger people), education (participants with a higher educational level rated sneezing in the elbow as more effective than people with a lower educational level), and perceived vulnerability to disease (participants feeling vulnerable rated sneezing as more effective than those who felt less vulnerable).

Discussion

The two recent influenza outbreaks have initiated a turning point in the management of health crisis by authorities. But organization of massive public health campaigns in the name of the precautionary principle without evidence of a health crisis in the public eye [10] has enlarged the already existing gap between scientific experts and the public [18]. Many commentators have speculated on the deleterious impact that a crisis of trust between the public and health authorities could have on compliance with recommendations in the case of future pandemics [4, 10]. We took the opportunity offered by the 2009 pandemic (H1N1) outbreak to test the causal impact of trust in medical organizations and governments on vaccination behaviors in Switzerland. In a two-wave longitudinal study, we measured trust in medical organizations and governments as well as beliefs about health issues at the beginning of the outbreak, using these variables to predict vaccination status and perceived efficacy of recommended protection measures a year later.

Results show that only trust in medical organizations predicted vaccination behavior whereas beliefs about health issues and trust in medical organizations both predicted the perceived efficacy of most of the official recommendations. This implies that (1) predicting efficacy is not equivalent to predicting behavior, and (2) the question of trust is central in the management of infectious diseases like influenza.

The first point is closely linked with research on the link between attitudes and behaviors, or in other words, how to predict behavior [19]. Classical models use attitudes and intentions as determinants of actual behaviors [11, 12, 20] but few studies investigate in fact actual behaviors which are difficult to capture. In the case of influenza, beliefs about disease, such as worry, vulnerability or conspiracy ideas affect vaccination intentions [9]; worry and vulnerability also affect perceived efficacy of health recommendations [8]. Our results about health recommendations replicate these findings because perceived efficacy of these recommendations is predicted by perceived vulnerability to disease and perceived threat. But only trust in medical organizations predicts pandemic (H1N1) 2009 vaccination status, which confirms the importance of managing trust for fostering compliance with public health campaigns [4].

Interestingly, different protection measures are predicted by different beliefs. Perceived vulnerability to disease affected perceived efficacy of washing hands and sneezing in the elbow, but not of wearing a mask or getting vaccinated. Conversely, perceived influenza threat predicted perceived efficacy of wearing a mask or getting vaccinated but not of other protective measures. Washing hands and sneezing in the elbow might be construed as generic hygienic rules not specific to influenza protection, whereas mask wearing and vaccination are specific to influenza. This implies that protective measures differ in their *symbolic connotations* [21]. For example, wearing a mask might have been seen as stigmatizing; indeed in May 2009, *Le Matin*, a widely read French-speaking Swiss newspaper published an article titled: "We have tried the mask: it will not protect you from ridicule".

Our study has some methodological limitations. The first concerns our sample size which is smaller than usual samples in public health survey studies. But this problem is inherent to our longitudinal design which excluded the possibility of including new respondents at Wave 2. As a consequence, the characteristics of our final sample were determined by the sample at Wave 1. This limitation is offset by the power of a longitudinal study to demonstrate causal effects. A second limitation is that some variables (knowledge and perceived threat) measured at Wave 1 were about avian influenza and not about pandemic (H1N1) 2009. Of course, it was impossible to anticipate the pandemic (H1N1) 2009 outbreak and initially design a longitudinal study. Indeed, the pandemic (H1N1) 2009 outbreak occurred during Wave 1 and participants may have responded taking into account both avian influenza and pandemic (H1N1) 2009 influenza. However, surveys received before and after the outbreak did not affect our main dependent variables.

Despite these limitations, our study has important implications for the management of future influenza vaccination campaigns. Public trust in medical organizations is a crucial determinant of influenza vaccination behavior. It is therefore important to systematically manage trust in such campaigns. Indeed, recent controversies about the management of the 2009 pandemic (H1N1) have weakened the credibility of medical organizations. This could have critical consequences for containing future disease outbreaks. In the case of a new influenza outbreak, official recommendations for protective measures might not be followed by those members of the public who do not trust institutions disseminating these recommendations, thereby nullifying entire vaccination campaigns. Thus restoring trust between public and medical organization seems to be essential for the management of future pandemics.

Given the importance of trust as a predictor of vaccination behavior, future research is needed in other countries. Moreover research could focus on the content of trust (what kinds of beliefs do members of the public hold), its demographics (which segments of the public trust medical organizations, which do not), and on the specific steps or initiatives that could be undertaken to foster a trusting relationship between the public and medical organizations.

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