

Prevention of influenza among travellers attending at a UK travel clinic: beliefs and perceptions. A cross-sectional study

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Travellers' compliance with influenza vaccines and antiviral drugs remains very poor despite influenza being a frequent vaccine-preventable disease with levels of compliance varying from 58% to 72% depending on the beliefs and perceptions of travellers' regarding the prevention of influenza.

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Background Travellers' compliance with measures to prevent influenza through the use of antivirals and influenza vaccine remains very poor despite influenza being one of the commonest travel and vaccine-preventable diseases. A study was undertaken to assess travellers' beliefs, perceptions and intentions to take antivirals for the treatment and prevention of influenza during the H1N1 pandemic.

Methods A cross-sectional survey ($n = 96$) of travellers who attended the Royal Free Travel Health Centre, London, UK was undertaken in September 2009. A self-administered questionnaire was completed by a traveller in advance of their pre-travel health consultation. Logistic regression identified variables independently associated with compliance.

Results Influenza vaccination uptake for the 5 years preceding the study was found to be 20.8%. This was statistically significantly higher for older travellers and those with underlying health

conditions ($P < 0.005$). Mean intention to comply with antiviral drugs on a preventive and therapeutic basis was 58% and 72%, respectively, and this varied markedly with age and with dispensed antimalarial chemoprophylaxis.

Conclusion This study identifies some beliefs and perceptions travellers consider with regard to the therapeutic and preventive influenza use of antivirals during the H1N1 pandemic; it underscores the importance of travellers receiving hemisphere appropriate influenza vaccination. The external validity of these study findings requires further corroboration involving other travel clinics and different cohorts of travellers during seasonal activity or outbreaks of influenza. These findings could guide the development of future strategies for the prevention of influenza in travellers.

Keywords Antiviral drugs, belief, influenza, perception, travellers.

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Background

An estimated 900 million people per annum travel internationally and between 2.8–15% of travellers^{1–4} may be infected with influenza. Infected travellers may act as a vector for the influenza virus,^{5,6} introducing it into other communities, including their own upon return, with obvious public health consequences as demonstrated by the spread of severe acute respiratory syndrome (SARS) and pandemic influenza H1N1.^{7,8}

Influenza has the capacity to disrupt travel, and is capable of causing severe or even fatal illness. It is one of the

most frequent vaccine-preventable diseases in returned travellers. One study has demonstrated that travellers experienced one influenza event per 100 person-month abroad⁴. A large study analysing the incidence of vaccine-preventable disease in returned international travellers showed that 12.1% of travellers with a vaccine-preventable disease had influenza as compared with enteric fevers (47.6%) and hepatitis A (16.7%)⁹. Despite influenza being a common, and at times severe or even fatal illness, advice offered to travellers may be inadequate: a large Geosentinel study found that business travel was significantly associated with a diagnosis of influenza ($P < 0.001$), only 22.5% of business

travellers had completed a pre-travel health consultation.⁹ A survey of US travellers found that although the majority of interviewees were aware of influenza prevention measures, only 41% had received influenza vaccination in the preceding season.¹⁰ This lack of concern and awareness in travellers might perhaps be due to the disease being perceived, incorrectly, as not 'travel related'.¹¹

Information on the epidemiology of influenza and its seasonality is important in planning its prevention and treatment in travellers. In temperate latitudes, influenza is generally a winter illness; in tropical latitudes, it is more perennial and may peak at times travel health practitioners are unaware of.^{12–16} An additional risk in the tropics might be through transmission by person to person contact in addition to the more usual droplet and aerosol spread.¹⁷

Different strains of seasonal influenza virus tend to circulate in the northern and southern hemispheres, which are reflected in the annual composition of the influenza vaccine; an important consideration is that travellers may not be protected when the circulating strains are mismatched for the northern and southern hemispheres.^{18,19} In addition, within the same hemisphere, the timing of influenza seasons and dominant strains may differ by continent, region and country.²⁰ Furthermore, both northern and southern hemisphere influenza virus strains may circulate simultaneously in the tropics.²¹ Importantly, strains from both hemispheres may circulate at international mass gatherings such as pilgrimages, resulting in vaccinated travellers not being adequately protected against influenza while travelling.^{22–26} When novel influenza strains emerge, no vaccine is usually available, as illustrated during the first months of the recent pH1N1 pandemic.^{27,28}

Antivirals may be used both for the treatment and prophylaxis of influenza when influenza vaccine is unavailable or contraindicated;²⁹ There is, therefore, a putative role for the carriage of antiviral drugs by travellers, for use on a 'stand-by treatment' basis; travellers might then also benefit from the greater therapeutic efficacy obtained from the early initiation of therapy.³⁰

Given the limited data on these issues, this study investigated, in the setting of a travel health consultation, travellers' beliefs and perceptions regarding measures to prevent infection with influenza, utilizing cognitive-intention and cognitive-behaviour approaches. The study sought to understand whether travellers would use antiviral therapeutic and stand-by treatment to treat infection with influenza if these were dispensed as part of a travel health consultation.

Methods

Setting

The study was conducted in September 2009 at the Royal Free Travel Clinic (London, UK), a World Health Organi-

zation (WHO) Collaborating Centre for Travellers' Health. The Travel Clinic is linked to University College London Medical School and provides travel health risk assessments and a clinical travel health service to residents of North London and further afield. North London is a reasonably affluent area, with a diversity of ethnic groups represented. Travellers comprised both business and leisure, including those travelling to visit friends and/or relatives (VFR).

Study design

A cross-sectional study was conducted through a questionnaire-based survey completed by 15.5% (96/621) of all travellers who attended the Royal Free Travel Clinic during the study period. One hundred travellers were recruited with participation being voluntary and with no financial incentive; four questionnaires were spoilt and could not be used as part of the analysis. The study period was kept quite short (1 month) to diminish the possible effect of publicity, which could bias the results. All subjects completed a signed informed consent after reading the study information sheet. The institutional ethical review board (Joint UCLH/UCL Biomedical Research Unit) approved the study, which was funded by an unrestricted educational grant from F. Hoffmann-La Roche, Basel, Switzerland, the manufacturer and marketer of oseltamivir phosphate. The funders had no role in the design or conduct of the study.

Self-administered questionnaire

A 12-item, anonymous, self-administered questionnaire was completed by travellers while waiting for pre-travel advice. The questionnaire took approximately 7 minutes to complete. Travellers were approached sequentially for participation and provided with a study information sheet and an informed consent form. The Information Sheet described the voluntary nature of participating, the benefits and risks of participation, and a statement on data privacy and protection; the study information sheet did not provide information on antiviral drugs or influenza.

The questionnaire was constructed using social cognitive theories as they apply to health-related behaviour.^{31,32} The questionnaire (see Table 1) applied the planned behaviour theory and was based on the main and proximal determinant of a travellers' behaviour, as well as their intention to perform the behaviour; the intention is thought to reflect the motivation and willingness to try and achieve the goals. A number of moderator variables were included to examine the cognitive-intention and cognitive-behaviour relationships as both 'direct experience' and to increase the predictive validity of the planned behaviour.

The questionnaire was designed to assess behavioural intention, personal attitude, perceived knowledge and motivation, which were taken as cognitive factors for this study; external behavioural and subjective norms could not be

Table 1. Assessment of Travelers' Individual Cognitive Factors Related to Influenza Prevention and Risk

Cognitive Factor	Question	Measure
Perception of knowledge about Influenza risk	Before reading the information sheet, were you aware that influenza could be serious or fatal illness? (q1)	Yes/No
Perception of knowledge about Influenza prevention (vaccine)	Before reading the information sheet, were you aware that a vaccine against influenza was available? (q3)	Yes/No
Perception of knowledge about Influenza prevention (antiviral drugs)	Before reading the information sheet, were you aware that influenza could be treated or prevented with specific antiviral drugs? (q6)	Yes/No
Intention to adhere (past experienced)	Have you received an influenza vaccination in the last five years? (q5)	Yes/No
Intention to adhere as a preventive measure	Would you consider taking Oseltamivir or Zanamivir to prevent influenza if there were a risk of influenza at your destination? (q9)	Yes/No (If Yes which one)
Intention to adhere as a therapeutic measure	If you had Oseltamivir or Zanamivir with while travelling, and you developed symptoms of influenza, would you treat yourself with one of these drugs? (q7)	Yes/No (If Yes which one)
Attitude towards influenza prevention	Do you believe that vaccination against influenza will reduce your risk of acquiring influenza while you are travelling? (q4)	Yes/No
Perceived behavioural norm	–	
Perceived subjective norm	–	
Perception of difficulty to adhere or Perception of adherence depending on the risk	Would you consider taking Oseltamivir or Zanamivir to prevent influenza if there were a risk of influenza at your destination? (q9)	Yes/No (If Yes which one)
Belief/Perception of risk of influenza acquisition (depending on prevention)	Before reading the information sheet, were you aware that travel could alter your risk of acquiring influenza? (q2)	Yes/No
Motivation	Would you consider carrying Oseltamivir or Zanamivir with you while travelling to treat or prevent avian flu or pandemic influenza? (q11)	Yes/No (If Yes which one)

tested. The questionnaire was independently evaluated by two influenza experts as well as by travellers recruited into a pilot study ($n = 5$) to assess comprehension and reliability of the questionnaire. The questionnaire's consistency was measured by a test-retest in travellers on the same day, so that a high reliability coefficient was acquired. However, the high reliability coefficient could be an overestimate, as the two tests were administered quite close together in time, permitting some memory effect. Possible responses were deliberately dichotomous, to increase response rate and comprehension.

In addition to answering questions on influenza, subjects also provided socio-demographic data (sex, age), travel information (travel history, planned itinerary including travel duration, season, purpose of travel, whether travelling alone or accompanied) and health information (underlying conditions, perceived health, allergies, drugs consumption, pregnancy). Included in the analysis were those individuals who travelled for trekking (as backpacking), volunteering or missionary work (as cooperation), tourism (as holidays), labour (as business) or to visit their friends and/or family (as VFR). The health of each traveller was recorded at the

time of their attendance at the travel clinic and this was used to determine their self-perception of their health at that time. Administered travel-related vaccines and the prescription of antimalarial chemoprophylaxis were also recorded.

Statistical analysis

Factors associated with measures to prevent infection with influenza were investigated by applying two dependent variables: an intention to comply with influenza antiviral drugs used either as a preventive or therapeutic measure. Variables included were those related to a travellers' socio-economic and health status, to the travel itinerary itself and the cognitive factors generated from the questionnaire.

Statistical analysis was compared using the Chi-square test or the Fisher exact test; continuous variables were compared by use of either the Student's t test, or the Mann–Whitney U test when the data were not distributed normally. To adjust for potential confounders, all covariates found to be significantly associated ($P < 0.05$) with the dependent variables in the bivariate analysis were considered for inclusion in the binary logistic regression analysis. Age was stratified in the bivariate analysis to facilitate

interpretation, but it was included as a continuous variable in the multivariate analysis. Beliefs, intention and perception questions were considered to be affirmative if travellers answered 'yes'. For both multivariate models, all data relating to a single respondent were excluded when any of variables included in the model had missing values.

The magnitude of the association between the intention to comply with influenza prevention measures and explanatory variables was measured by applying odds ratios (ORs), expressed as crude odds ratio in the bivariate analysis and adjusted odds ratio in the multivariate analysis, together with their corresponding 95% confidence intervals (CI₉₅). The model's ability to discriminate between groups was assessed with the area under the receiver operating curve (AUC); the model's calibration was examined using the Hosmer and Lemeshow test. All tests were two-tailed, and a *P* value of <0.05 was defined as statistically significant. All analyses were conducted using SPSS 11.0 Statistical Software Package (SPSS, Inc., Chicago, IL, USA).

Results

Study group

Data were available from 96 travellers who attended the Royal Free Travel Health Clinic in September 2009 (from 1st to 27th September 2009).

Table 2 summarizes the selected characteristics of the 96 travellers who constituted the sample size of 15.5% (96/621) of all travellers who attended the travel clinic at the time of the study. The median age was 32 years (range: 18–71 years), with the majority of travellers being female (56%); 75.6% had no underlying medical condition, 87.8% were travelling alone, 38.9% were travelling to Asia and 41.4% were backpackers with an intended median duration of travel of 32 days (range: 4–1460 days). Acceptance of at least one recommended vaccine while attending the travel clinic was 93.3% and antimalarial chemoprophylaxis was dispensed to 52.7% of travellers.

The seasonal influenza vaccination coverage for the preceding 5 years was 20.8% (20/96), being statistically significantly higher for older (>60 years old) travellers (66.7%; 4/6; *P*-value = 0.018) than younger travellers (18.6%; 16/86), and for travellers with an underlying medical condition (45.5%; 10/22; *P*-value = 0.026) when compared against healthy travellers (13.5%; 10/74). Influenza vaccine is administered in the United Kingdom without charge to those aged 65 years and over and for those with a serious underlying medical condition, a reflection of these findings.

Compliance with influenza antiviral drugs as a preventive measure

The overall intention by travellers to take influenza antiviral drugs as a preventive measure (Table 2) was 58.3%

and did not differ by age (58.0% among <40 years; 56.5% for ≥40 years, *P* = 0.903), nor by other personal or travel characteristics (*P* > 0.05). When asked specifically which of the two licensed neuraminidase inhibitors subjects would choose for prophylactic use, the majority (81.0%) indicated oseltamivir ahead of zanamivir (19.0%).

Compliance with influenza antiviral drugs as a therapeutic measure

The overall intention to take influenza antiviral drugs as a therapeutic measure (Table 2) was 74.2% with compliance differing markedly by age (56.5% <40 years; 81.8% ≥40 years, *P* = 0.015), and by dispensed antimalarial chemoprophylaxis (59.5% among non-dispensed; 84.8% among dispensed, *P* = 0.008). Other personal or travel characteristics did not influence a travellers intention to comply (*P* > 0.05). In addition, travellers were asked which of the two licensed neuraminidase inhibitors they would choose for treatment: the majority (82.0%) selected oseltamivir ahead of zanamivir (18.0%).

Beliefs and perceptions towards Influenza prevention measures

Table 3 describes travellers' beliefs and perceptions related to their intention to comply with influenza prevention measures. Most travellers reported that they were aware of the severity of infection with influenza (90.6%), the availability of influenza vaccine (93.8%) and the availability of specific influenza antiviral drugs (78.1%); in addition, they perceived travel as a risk factor for acquiring influenza (71.9%). However, only 57.3% reported that they would receive influenza vaccine and only 20.8% reported having received an influenza vaccine in the preceding 5 years.

By bivariate analysis (see Table 3), negative perceptions of knowledge about influenza prevention (i.e. being unaware that a vaccine against influenza was available), positive attitudes towards influenza prevention (i.e. belief that vaccination against influenza will reduce the risk of acquiring influenza while traveling) and motivation (i.e. would consider carrying oseltamivir or zanamivir while travelling) were significantly associated with the intention to comply with influenza antiviral drugs as a preventive measure. Knowledge about the potential risk of infection with influenza while travelling and a positive attitude and motivation towards prevention of influenza were significantly associated with an intention to comply with influenza antiviral drugs as a therapeutic measure.

Variables predicting intention to comply with influenza antiviral drugs

After consideration of variables exploring demography, beliefs and knowledge towards compliance with influenza prevention measures (Table 3; adjusted Odds Ratio), a

Table 2. Description of travellers' characteristics

Variable	Travellers (n = 96)	Intention to adhere to antiviral drugs			
		Preventively	P-value	Therapeutically	P-value
Sex					
Male	42 (43.8)	27 (64.3)	0.297	29 (69.1)	0.498
Female	54 (56.2)	29 (53.7)		40 (74.1)	
Age*					
Median, IQR (years)	32.0 (13.0)	32.0 (14.0)	0.758	31.0 (13.0)	0.028
<40	69 (75.0)	40 (75.5)	0.903	54 (80.6)	0.015
≥40	23 (25.0)	13 (24.5)		13 (9.4)	
<60	86 (93.5)	49 (92.5)	1.000***	64 (95.5)	0.158
≥60	6 (6.5)	4 (7.5)		3 (4.5)	
Fit and well**					
No	1 (1.1)	0 (0.0)	0.433***	1 (1.6)	1.000
Yes	89 (98.9)	51 (57.0)		63 (70.8)	
Drugs consumption**					
No	62 (68.9)	38 (61.3)	0.188	45 (72.6)	0.651
Yes	28 (31.1)	13 (46.4)		19 (67.9)	
Underlying condition**					
No	68 (75.6)	40 (58.8)	0.468	50 (73.5)	0.411
Yes	22 (24.4)	11 (50.0)		14 (63.6)	
Antimalarial prescription**					
No	43 (47.3)	28 (65.1)	0.146	25 (58.1)	0.008
Yes	48 (52.7)	24 (50.0)		39 (81.3)	
Vaccination prescribed**					
No	6 (6.7)	3 (50.0)	1.000***	4 (66.7)	0.653
Yes	84 (93.3)	48 (57.1)		60 (71.4)	
Prior travelling**					
No	68 (74.7)	36 (52.9)	0.164	49 (72.1)	0.580
Yes	23 (25.3)	16 (69.6)		15 (65.2)	
Travel purpose**					
Backpacking	37 (41.1)	20 (54.1)	0.975	26 (70.3)	0.502
Volunteering/Missionary	2 (2.2)	2 (100.0)		2 (100.0)	
Holidays	18 (20.0)	9 (50.0)		13 (72.2)	
Business	18 (20.0)	11 (61.1)		11 (61.1)	
VFR	15 (16.7)	9 (60.0)		12 (80.0)	
Duration of stay**					
Median, IQR (in days)	30 (166)	39 (182)		25 (138)	
<28	44 (48.9)	25 (49.0)	0.977	33 (51.6)	0.506
≥28	46 (51.1)	26 (51.0)		31 (48.4)	
Destination by North versus South Hemisphere or tropics**					
No	48 (53.3)	31 (64.6)	0.105	34 (70.8)	0.938
Yes	42 (46.7)	20 (47.6)		30 (71.4)	
Travel continent**					
Africa	29 (32.2)	16 (55.2)	0.495	22 (75.9)	0.874
Latin America	13 (14.4)	9 (69.2)		11 (84.6)	
Asia	35 (38.9)	19 (54.3)		22 (62.9)	
SE Europe	3 (3.3)	3 (100.0)		2 (66.7)	
Oceania	10 (11.1)	4 (40.0)		7 (70.0)	

Data are no. (%) of patients, unless otherwise indicated.

*Age was unknown for 4 patients.

**Age was unknown for 6 patients.

***P value obtained by Fisher's exact test.

Table 3. Distribution of Intention to adhere to antiviral drugs as a preventive measure

	Travellers (n = 96)	Intention to adhere to antiviral drugs preventively	Crude Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)*
Positive perception of knowledge about Influenza risk				
Yes	87 (90.6)	72 (82.8)	0.67 (0.16–2.88)	
No	9 (9.4)	5 (55.5)		
Positive perception of knowledge about Influenza prevention (vaccine)				
Yes	90 (93.7)	74 (82.2)	1.43 (0.27–7.49)	
No	6 (6.3)	3 (50.0)		
Positive perception of knowledge about Influenza prevention (antiviral drugs)				
Yes	75 (78.1)	63 (84.0)	0.26 (0.08–0.83)	0.14 (0.03–0.65)
No	21 (21.9)	14 (66.6)		
Intention to adhere				
Yes	20 (20.8)	17 (85.0)	1.89 (0.66–5.44)	
No	76 (79.2)	60 (78.9)		
Intention to adhere as a therapeutic measure				
Yes	69 (74.2)	44 (63.8)	1.76 (0.69–4.50)	
No	24 (25.8)	12 (50.0)		
Positive attitude towards influenza prevention				
Yes	55 (57.3)	41 (74.5)	5.08 (2.11–12.22)	4.26 (1.54–11.73)
No	41 (42.7)	15 (36.6)		
Belief/Perception of risk of influenza acquisition (depending on prevention)				
Yes	69 (71.9)	37 (53.6)	0.49 (0.19–1.26)	
No	27 (28.1)	19 (70.4)		
Motivation				
Yes	67 (69.8)	47 (70.2)	5.22 (2.03–13.43)	4.66 (1.52–14.30)
No	29 (30.2)	9 (31.0)		

Data are no. (%) of patients, unless otherwise indicated.

*Adjusted by age, gender and question 4 (Do you believe that vaccination against influenza will reduce your risk of acquiring influenza while you are travelling?), question 6 (Before reading the information sheet, were you aware that influenza could be treated or prevented with specific antiviral drugs?) or question 11 (Would you consider carrying Oseltamivir or Zanamivir with you while travelling to treat or prevent avian flu or pandemic influenza?) when needed (Hosmer-Lemeshow 0.801, AUC 0.813; 95% CI 0.723–0.903).

lack of knowledge about influenza prevention and a positive attitude towards the prevention of influenza were independently associated with an intention to comply with influenza antiviral drugs as a preventive measure. On the other hand, knowledge about the potential risk of infection with influenza was independently associated with an intention to comply with influenza antiviral drugs as a therapeutic measure (Table 4; adjusted Odds Ratio).

Discussion

The study was conducted during a declared influenza pandemic, phase 6 of the influenza pH1N1 pandemic. As a newly emerged global health threat, the pH1N1 virus posed significant challenges to public health and media information strategies.^{33,34} In the initial stages of the pandemic, an absence of information about the virus as well as a lack of an effective vaccine or knowledge about the effectiveness of antiviral drugs created significant anxiety.³⁵ It was in this

context that measures of protection were promoted; however, the effectiveness of control measures in a pandemic depends on the awareness of the general population and their willingness to cooperate, which in turn is likely to be associated with the perceived personal risk of contracting influenza. It was for these reasons that it was hypothesized that travellers would have a raised awareness regarding infection with influenza and be willing to receive preventive and stand-by interventions against influenza. However, public awareness and anxiety can wane during a major public health incident, related to disease severity and media coverage. Evidence from national telephone surveys in the United Kingdom over the period 1 May 2009 to 10 January 2010 supports this assertion, and psychological processes should be considered when designing health interventions.³⁵

Although, at least in theory, compliance with influenza prevention measures should be quite simple,^{36–39} the acceptability of these measures among travellers was unknown. To our knowledge, our study is the first to

Table 4. Distribution of Intention to adhere to antiviral drugs as a therapeutic measure

	Travellers (n = 96)	Intention to adhere to antiviral drugs therapeutically	Crude Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)*
Positive perception of knowledge about Influenza risk				
No	9 (9.7)	3 (33.3)	7.33 (1.67–32.24)	7.02 (1.11–44.21)
Yes	84 (90.3)	66 (78.6)		
Positive perception of knowledge about Influenza prevention (vaccine)				
No	6 (6.5)	3 (50.0)	3.14 (0.59–16.76)	
Yes	87 (93.5)	66 (75.9)		
Positive perception of knowledge about Influenza prevention (antiviral drugs)				
No	21 (22.6)	14 (66.7)	1.62 (0.56–4.66)	
Yes	72 (77.4)	55 (76.4)		
Intention to adhere				
No	73 (78.5)	54 (74.0)	1.06 (0.34–3.30)	
Yes	20 (21.5)	15 (75.0)		
Intention to adhere as a preventive measure				
No	37 (39.8)	25 (67.6)	1.76 (0.69–4.50)	
Yes	56 (60.2)	44 (78.6)		
Positive attitude towards influenza prevention				
No	38 (40.9)	23 (60.5)	3.33 (1.27–8.76)	2.56 (0.76–8.70)
Yes	55 (59.1)	46 (83.6)		
Belief/Perception of risk of influenza acquisition (depending on prevention)				
No	27 (29.0)	18 (66.7)	1.70 (0.63–4.56)	
Yes	66 (71.0)	51 (77.3)		
Motivation				
No	26 (28.0)	13 (50.0)	5.09 (1.87–13.90)	3.26 (0.93–11.37)
Yes	67 (72.0)	56 (83.6)		

Data are no. (%) of patients, unless otherwise indicated.

*Adjusted by age, gender, antimalarial prescription and question 4 (Do you believe that vaccination against influenza will reduce your risk of acquiring influenza while you are travelling?), question 1 (Before reading the information sheet, were you aware that influenza could be serious or fatal illness?) or question 11 (Would you consider carrying Oseltamivir or Zanamivir with you while travelling to treat or prevent avian flu or pandemic influenza?) when needed (Hosmer-Lemeshow 0.394, AUC 0.816; 95% CI 0.696–0.936).

evaluate the associations between determinants of intention by travellers to comply with antiviral recommendations and individual cognitive factors. Of importance, the findings relate to the general population in as much as the majority of the sampled population did not possess any underlying medical condition (75.6%).⁴⁰

We believe that utilization of behavioural theory enabled us to gain some understanding of the factors governing traveller's choices, providing some insights into questions around 'compliance' or 'adherence', an important issue in travel health, given that many of the discipline's interventions are prophylactic in nature. To some extent, this was confirmed by our finding that an intention to comply with antiviral prescription was strongly associated with prophylactic antimalarial prescription. This finding gels with the notion that adding influenza prevention and treatment to the offerings of travel clinics could be of benefit to the travelling public.

Our study has three main limitations: a small sample size, internal validity and 'fear generalisability'. Undertaken

during the pandemic at a time when the evolution of the pandemic was uncertain, we cannot exclude biases introduced by the mass media. It was for this reason that we kept the study period relatively short. In addition, we surveyed only one traveller per family, to avoid grouping answers and decreasing external validity; these two measures would also have impacted our response rate. This might also explain why older travellers are not well represented, although it should be noted that the mean age of travellers attending our travel clinic in 2009 was 40.0 (SD 15.4), with <10% being 60 years or older, an age profile quite similar to that of the study sample where the median age was 32 years old. For these reasons, we believe that our findings should be confirmed in a large cross-sectional study.

Although an intention to comply with preventive antiviral recommendations was predicted mainly by variables relating to knowledge and perception of effective preventive measures, intention to comply with therapeutic recommendations was predicted only by knowledge of the severity of

infection with influenza, the latter being an important finding.

The study was conducted on attendees of the Royal Free Travel Clinic during September 2009, and likely represents a broad cross-section of travellers. Availability of influenza vaccines and antivirals will likely differ by country and setting, but it would seem sensible to make these interventions available in travel clinics, especially as the public's influenza awareness in the post-pandemic period is likely to be heightened.

Of note, seasonal influenza coverage in travellers in the preceding 5 years was quite low, around 20%, with reports in the literature citing rates in travellers of 13.7–41%,^{10,41} although rates were not inconsistent with those seen in high-risk groups in the general population, such as those with underlying medical conditions or advanced age. Interestingly, comparing the seasonal influenza vaccine target groups of elderly people and those with chronic illnesses, one notes similarities between our results (66.7% and 47.0% respectively) and those reported by the Health Protection Agency (HPA) on behalf of Department of Health for registered patients in general practices in England for 2003–4 (78.1% in 2005–6 for 65 or over aged population and 47.2% in 2003–4, respectively),⁴⁰ and quite consistent with that observed in Swiss business travellers (27.2%).⁴²

To increase the intention to comply with influenza antiviral use in travellers, practitioners might usefully explain the use and role of vaccines and antiviral drugs; where constraints on the use of antivirals exist, practitioners might challenge these on scientific grounds.^{43–46} Consideration should be given where considered clinically appropriate, to travellers being provided with antivirals to carry with them on a stand-by basis; traveller acceptance of this strategy is likely to be improved by explanation that influenza can be a severe illness. A particular consideration would be a caution with the prescription of stand-by antivirals for travellers to malarious areas,⁴⁷ given that malaria may present as influenza-like illness: seasonality and destination would need consideration by the prescribing practitioner. Support for this strategy comes from a recent study conducted in business travellers, which detected good knowledge of the transmission and symptoms of influenza; interestingly, 9.7% of travellers in this study acknowledged having carried antiviral medication on their last business trip, with 7.0% of travellers having actually used the carried medication.⁴²

Of interest, and a possible indication of the public's acceptance of the concept of stand-by medication for the treatment of influenza, was the unexpected increase in 2005 of oseltamivir prescriptions, for use during a future outbreak of H5N1 influenza virus infection,⁴⁸ attributed to widespread personal stockpiling.⁴⁹ Some studies have proposed individuals' personalities and their degree of apprehension about avian influenza, rather than differences in

their knowledge as the basic reason for this personal stockpiling.⁵⁰ The purchase of very large antiviral stockpiles by many developed countries assuages equity of access objections to personal stockpiling, at least for travel purposes. An issue for travellers is the accessibility of safe and effective antivirals when travelling. The widespread practice of counterfeiting and lack of security in the drug supply in some regions argues for the carrying of personal medication sourced in the traveller's home country.

To increase the intention to comply with antiviral drugs as a preventive measure, it may be useful to develop a health education campaign about the availability and safety of specific antiviral drugs, as well as the efficacy of the prevention measures. A recent opinion by the US Advisory Committee on Immunization Practice recommends prompt antiviral therapy for high-risk groups, and for non-high-risk groups when treatment can be initiated within 48 hours of symptom onset, a view not incompatible with the provision of antiviral emergency stand-by medication (ESBM) to travellers.⁵¹

This study identifies some of the beliefs and perceptions travellers hold with regard to the prevention of influenza and in particular, during the H1N1 pandemic. As a common vaccine-preventable disease, influenza vaccination should be recommended for travellers alongside the necessity for the year round availability of hemisphere appropriate influenza vaccination. Although our findings suggest that there is a role for travel clinics in both the prevention and treatment of influenza in travellers, corroboration of our findings in other travel clinic settings and among different cohorts of travellers is desirable. This could enable potentially the development of future guidance for the prevention of influenza in travellers, a highly mobile population who can introduce infections into susceptible populations with the potential public health consequences.

Conflict of interest

S.T. is a former employee of, and is a paid consultant to F. Hoffmann-La Roche and different influenza vaccine and antimalarial manufacturers; J.N.Z. has been a consultant to several manufacturers of vaccines and antimalarial chemoprophylaxis and has received unrestricted educational grants from GlaxoSmithKline, Novartis, Sanofi Pasteur, SBL Vaccines and Pfizer, for attending conferences, running educational programmes and undertaking clinical trials. No other potential conflicts of interest have been reported.

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