

Respiratory hygiene practices by the public during the 2009 influenza pandemic: an observational study

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Aims To describe the public use of respiratory hygiene behaviours during the 2009 influenza pandemic and to test the feasibility of an observational method.

Methods Respiratory behaviour was systematically observed at three public settings during August 2009 in the capital city of New Zealand (Wellington). Data on each coughing or sneezing event were collected.

Results A total of 384 respiratory events were observed, at a rate of 0.8 cough/sneeze per observed-person-hour. Around a quarter of respiratory events (27.3%) were uncovered, and there was infrequent use of the responses recommended by health authorities (i.e., covering with a tissue or handkerchief at 3.4% and covering with elbow or arm at 1.3%). Respiratory event rates were higher in all settings that were 'high flow' (for people movement) compared to 'low flow' settings. Uncovered events were more common among people at the hospital entrance versus

the hospital café [risk ratio (RR) = 7.8, 95% confidence interval (CI): 1.1–52.6] and when a person was located within 1 m of others (RR = 1.5, 95% CI: 1.1–1.9).

Observing respiratory hygiene was found to be feasible in all of the selected public locations. There was good agreement between observing pairs about whether or not respiratory events occurred (inter-observer correlation = 0.81) and for uncovered versus covered events (total Cohen's kappa score = 0.70).

Conclusions It was feasible to document respiratory hygiene behaviour in public urban settings during a influenza pandemic. Respiratory hygiene advice was not being adequately followed by this population towards the end of the first wave of the pandemic.

Keywords Coughing, health promotion, pandemic influenza, respiratory hygiene.

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Introduction

Pandemic influenza A (H1N1) virus was first detected in New Zealand in April 2009 among a group of high school children returning from Mexico.^{1,2} The pandemic escalated rapidly in June, and New Zealand formally switched to the 'manage it' phase of the 'Pandemic Influenza Action Plan' on 22 June.³

Public health consensus supports the use of pandemic control measures such as hand washing and respiratory hygiene,^{4,5} although the evidence base for the effectiveness of such interventions against respiratory infections is still not definitive. For example, two studies of hand washing in child care and school settings,^{6,7} which were included in a systematic review,⁸ suggested benefits, but both studies were considered to be at 'high risk' of bias in this review.⁸ An earlier meta-analysis also reported that the eight studies

considered were of 'poor quality', although the pooled result did indicate benefit i.e., 'hand cleansing can cut the risk of respiratory infection by 16% [95% confidence interval (CI): 11–21%].'⁹

In New Zealand, the Ministry of Health's key objectives during the pandemic were to 'reiterate existing public health messages such as hand washing and cough etiquette'.³ The primary messages presented in a media campaign were stay at home if you have symptoms, wash your hands regularly and cover your cough (with some health education material explicitly advising 'covering your cough with a tissue' or coughing 'into your upper sleeve'). Given this background, we aimed to describe the public use of respiratory hygiene behaviours during this pandemic and to test out the feasibility of an observational method. This work accompanied a separate observational study of hand hygiene by the public at the same time.¹⁰

Methods

This study was carried out at the tail end of the first influenza pandemic wave in New Zealand¹ (weekdays between 6 and 14 August, a winter month in New Zealand). However, there were still ongoing pandemic-related deaths during this and subsequent months. Three settings were selected for observation in the country's capital city (Wellington): the railway transport system, the main hospital (Wellington Regional Hospital) and a central city shopping mall. These sites were further divided into 'high-flow' and 'low-flow' areas based on the rate of movement of people through the areas, giving a total of six sample populations for observation. Thirteen fourth-year medical students were the observers for this study.

A standard form was used to record all observations. Age bracket (children <12 years, teenagers 12–19 years and adults >19 years) and gender were visually assessed and recorded for each person. It was noted whether the respiratory event was a cough or a sneeze and what respiratory hygiene behaviour the individual had shown (uncovered/covered, use of: handkerchief/tissue/hand/elbow/arm). The observers also noted whether another person was within 1 m of the event and whether the subject exhibited multiple respiratory events (potentially indicating a greater likelihood of respiratory infection). If multiple events were observed, only the first was recorded.

The denominator for the observational work was 'observed-person-time' that comprised the total number of

different people observed in each observational session multiplied by the average time they were observed for (i.e., it was possible for each observer to observe multiple people at the same time). For the low-flow settings, this average was estimated for each data collection episode (mean 21.5 minutes, range 12–30 minutes), but in the high-flow areas, it was taken to be 5 seconds per person (based on pilot study work). There were a total of 45 observational episodes over 28.3 hours of observers' time.

Validity and reliability of these observational methods were also investigated. Events that were heard but not visually observed were recorded as 'missed'. Inter-observer variation was assessed during a specific one-hour period at each site where a non-communicating pair of observers collected data separately. Ethical approval for this work was obtained through the ethics approval process of the University of Otago.

Results

A total of 384 respiratory events were observed, giving a rate of 0.8 events per observed-person-hour (Table 1). The overwhelming majority of events were cough (94.5%) with the remainder being sneeze (5.5%). The observation of multiple respiratory events in the same subject occurred in 23.4% of the sample population. Respiratory event rates were higher in all 'high-flow' settings compared to 'low flow' settings, for example 27 per observed-person-hour at the hospital entrance compared to 0.2 in the hospital café

Table 1. Observed respiratory events by setting during an influenza pandemic (Wellington, New Zealand, August 2009)

Setting	People observed (N)	Observed events (N)	Uncovered events		Total observed-person-hours***	Events per observed-person-hour
			Risk ratio (95% CI)	% (N)		
Railway carriage*	399	109	24.8 (27/109)	Reference 1.0	125.8	0.9
Railway station entrance**	30 890	96	25.0 (24/96)	1.0 (0.6–1.6)	42.9	2.2
Hospital café*	174	16	6.3 (1/16)	Reference 1.0	75.0	0.2
Hospital entrance	1804	68	48.5 (33/68)	7.8 (1.1–52.6)	2.5	27.1
Shopping mall food court*	570	84	19.0 (16/84)	Reference 1.0	208.3	0.4
Shopping mall entrance	1582	11	36.4 (4/11)	1.9 (0.8–4.7)	2.2	5.0
Total/mean	35 419	384	27.3 (95% CI: 23.1–32.0)	–	456.8	0.8 (range: 0.2–27.1)

*'Low flow' environment in terms of movement of people (including periods where no people were observed).

**The railway station was the only setting where estimated person flow rates were used to obtain the total observed-person-time (in contrast to counting all individuals passing by in all of the other settings). This was because the large numbers of people moving through the railway station at certain times made the precise counting of people too difficult for the observers.

***Calculated from the number of people observed in each observational period for each setting multiplied by the average time, they were observed for (in seconds). See Methods for more detail.

(Table 1). When comparing the occurrence of uncovered events between high-flow and low-flow settings, the only significant difference was that between the hospital café and the hospital entrance, with a risk ratio (RR) of 7.8 (95% CI: 1.1–52.6). There were no significant differences in behaviours between men and women or between adults and children/teenagers. However, of the 384 events observed, only 4% and 11% involved children and teenagers, respectively.

Covering respiratory events with the hand (64.4%) was the most common behaviour observed. The use of a tissue or handkerchief (3.4%) and covering with elbow or arm (1.3%) were much less common. The location with the highest proportion of these recommended behaviours was the hospital café (covered with tissue/handkerchief: 12.5%; elbow/arm: 6.3%) followed by the shopping mall food court (tissue/handkerchief: 9.1%; elbow/arm: 0%), the shopping mall entrance (tissue/handkerchief: 4.8%; elbow/arm: 2.4%) and the railway station entrance (tissue/handkerchief: 6.3%; elbow/arm: 0%). Such behaviours were rarely observed in railway carriages (tissue/handkerchief: 0%; elbow/arm: 1.8%) and not at all in the hospital entrance.

People with multiple respiratory events were more likely to cover their cough/sneeze; however, this pattern was not at a statistically significant level. Uncovered events were actually *more common* when a person was located within 1 m of others (RR = 1.5, 95% CI: 1.1–1.9). No one was observed to be wearing a mask.

Observing respiratory hygiene was found to be feasible in all of the selected public locations. There were 41 missed cough/sneeze over a specific 10-hour observation period for which such data were collected, suggesting that in the total of 28.3 hours of observation time in this study, there would have been approximately 116 missed events (a ratio of one per 3.3 observed events). There was good agreement between observing pairs about whether or not respiratory events occurred (inter-observer correlation = 0.81) and for uncovered versus covered events (total Cohen's kappa score = 0.70).

Discussion

This is the first study of directly observed respiratory hygiene behaviour in a developed country setting that we are aware of. A study of respiratory hygiene has recently been reported in a developing country (Bangladesh), although this was conducted just prior to the 2009 pandemic.¹¹

The findings from this study suggest that coughing and sneezing in public areas is a relatively common behaviour (i.e., an average of 0.8 events per observed-person-hour). The observation of multiple respiratory events in the same

subject (23.4%) suggests that at least a proportion of these people had a respiratory tract infection and were not following the advice during the pandemic from health authorities to remain at home. This study also showed that potentially hazardous respiratory behaviours (e.g., uncovered cough within a metre of another person) are a common event even during a well-publicised influenza pandemic in which people were dying. These deaths and hospitalisations were reported in detail in the New Zealand mass media.

The research base used for modelling how influenza might spread in a population has tended to be based on reported contact patterns,¹² rather than using data on observed potential transmission events (e.g., cough). Therefore, results from this type of research could potentially inform modelling studies of infectious disease transmission risk.¹³ A particular strength of observational studies is that they record what people actually do, rather than their reported behaviour.¹⁴ This is especially relevant for behaviours that are unlikely to be remembered in any detail (such as coughing) and for hygiene behaviours for which social desirability bias may be relevant.

This study also showed a low prevalence of recommended respiratory hygiene behaviours (e.g., only 4.7% used a tissue, handkerchief or elbow to cover their cough), suggesting that hygiene messages were not been seen and/or readily adopted by the public. Further conclusions about the effectiveness of advertising campaigns run by New Zealand health authorities are limited by the absence of baseline information on respiratory hygiene in this country.

One of the study aims was to determine whether an observational design of this kind was feasible and whether it could provide reliable and valid data. A high number of events recorded in the available study time suggest that such studies are indeed feasible. The high scores for inter-observer reliability also support this method. However, refinements could be made in future such studies. The quality of data collection could have been further improved by formal observer training before the study was commenced. This form of study could also lend itself to the use of closed-circuit television as a method for improving the accuracy (validity and reliability) of observational data collection, although safeguards would be essential to protect civil liberties and privacy. Such approaches would allow for far more accurate assessment of the 'observed-person-hour' denominator.

It would be useful to extend this type of observational study for interpandemic ('seasonal') influenza in temperate countries. Ideally, further research would measure such behaviours in a much wider range of settings e.g., homes, schools and workplaces. For settings where there are readily available hand-washing opportunities, the use of hand

washing after coughing into hands could also be studied. Observational data could be supplemented with survey data on public knowledge of hygiene and attitudes to hygiene measures. While further research of new influenza vaccines is particularly critical, health authorities should not neglect funding research on basic hygiene behaviour among the general public and strive to evaluate their mass media interventions on hygiene messages.

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Competing interests

The authors have no competing interests.

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