Chronic disease and hospitalisation for pandemic (H1N1) 2009 influenza in Indigenous and non-Indigenous Western Australians

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Abstract

Indigenous and non-Indigenous Western Australians with pandemic (H1N1) 2009 influenza (pH1N1) infection were compared for risk factors, influenza vaccination history, symptoms, use of antiviral medications, and hospitalisation. Data was collected systematically on 856 notified cases with laboratory confirmed pH1N1 infection during the first 10 weeks of pH1N1 virus transmission in Western Australia in 2009. Indigenous people with pH1N1 were approximately 3 times more likely to be hospitalised and were more likely to have a range of underlying medical conditions and be smokers, compared with non-Indigenous cases. Age ($P < 0.001$) and the presence of two or more co-morbidities ($P < 0.001$) were independent predictors of hospitalisation, while Indigenous status was not, indicating that higher pH1N1 hospitalisation rates in Indigenous Australians during the 2009 winter season were attributable to the higher prevalence of underlying chronic disease. These results underscore the need to ensure that influenza vaccination is delivered as widely as possible among those with chronic health conditions. *Commun Dis Intell* 2011;35(2):172–176.

Keywords: pandemic (H1N1) 2009 influenza, chronic disease, hospitalisation, Indigenous, Western Australia

Introduction

It has long been recognised that Indigenous populations are at an increased risk of suffering adverse consequences and complications associated with influenza infection.[1,2] Indigenous populations of Australia, New Zealand, Canada, Brazil, and the Pacific Islands were shown to be particularly vulnerable to pandemic influenza A (H1N1) 2009 (pH1N1) infection, with disproportionately higher rates of hospitalisation and mortality.[3] Although Indigenous populations comprise less than 5% of the total population in Canada and the United States of America, they represented almost 18% of all hospitalisations due to pH1N1 infection.[3] Similarly, in comparison to non-Indigenous populations, the rate of severe acute respiratory illness in Brazilian Amerindians infected with pH1N1 was 4.5 times higher, the hospitalisation rate in New Zealand Maoris was 3 times higher, and the hospitalisation and mortality rate among Australian Aborigines were 7.7 and 5.1 times higher respectively.[3] The Indigenous population in the top end of Australia's Northern Territory were 12 times more likely to be hospitalised and 5 times more likely to be admitted to intensive care.[4] Twenty per cent of 4,808 hospitalisations attributed to pH1N1 during the 2009 winter in Australia were in Indigenous people, equating to an 8-fold higher hospitalisation rate compared with the non-Indigenous population.[5]

From May to September 2009, the notification rate of pH1N1 to the Communicable Disease Control Directorate (CDCD) in the Department of Health in Western Australia was 4 times higher among Indigenous people compared with non-Indigenous people.[6] After notification of the 1st case of pH1N1 in Western Australia in May 2009, the CDCD commenced an investigation of the impact of pH1N1 compared with co-circulating seasonal influenza. This provided an opportunity to compare Indigenous and non-Indigenous cases in terms of demographics, co-morbidities, influenza vaccination history, symptoms, use of antiviral medications and outcomes, and to determine if Indigenous status alone conferred an increased risk of hospitalisation for pH1N1, once other factors had been considered.

Methods

Influenza is a notifiable disease in Western Australia and all cases detected by pathology laboratories are reported to the CDCD. Pandemic H1N1 cases were recruited during the 10 week period from 29 May 2009 (4 days after notification of the 1st confirmed pH1N1 infection in Western Australia) to 7 August 2009, either as consecutive notifications or randomly, as described previously.[7] A case was defined as anyone notified to CDCD with laboratory confirmed pH1N1 diagnosed by nucleic acid testing during the study period. Cases were excluded if they had a co-infection with another influenza virus.

Demographic information for notified influenza cases was obtained from the Western Australian Notifiable Infectious Diseases Database. A ques-

tionnaire was administered via telephone by trained public health nurses to each selected case within 48 hours of receipt of the notification at CDCD. The case was briefed about the investigation and verbal consent was obtained to participate. A total of 6 attempts were made to contact the case after which they were deemed not contactable. The questionnaire gathered information on signs and symptoms of illness, hospitalisation, use of antiviral medications and underlying medical conditions. If a case was unable to answer the questionnaire, an adult household member most familiar with the case was interviewed as a proxy. Hospitalisation status was ascertained at the time of interview and by retrospectively checking all notified cases against a hospital discharge database encompassing all public hospitals and one large private hospital in Western Australia.[7] A case was defined as being hospitalised if they were admitted for one or more nights for illness caused or exacerbated by pH1N1 infection. Indigenous cases were those who identified themselves at time of interview to be of Aboriginal and/or Torres Strait Islander descent. Cases were excluded if Indigenous status was unknown or missing.

Human research ethics committee approval was not required as information was collected as part of the public health response to pH1N1. Statistical analyses were performed using PASW Version 17.0.2 (SPSS Inc., Chicago, IL). Differences in univariate data were assessed by χ^2 tests for proportions and t-tests for continuous variables. Univariate odds ratios (OR) and 95% confidence intervals (95% CI) for factors associated with hospitalisation were calculated using logistic regression. P values < 0.05 were considered statistically significant. Factors significantly associated with hospitalisation in univariate analyses were included in a multivariate logistic regression model with backwards stepwise elimination of variables.

Results

Over the 10-week study period, 984 pH1N1 cases that fulfilled the case definition were selected for inclusion. Of these, 871 cases (88.5%) were interviewed, 107 (10.9%) were not contactable, and 6 (0.6%) refused to participate. Hence, 871 pH1N1 cases were interviewed, but Indigenous status was not determined for 15 (1.7%), leaving 856 pH1N1 cases, of whom 63 (7.4%) were Indigenous. The proportion of Indigenous cases was more than twice as high as in the general Western Australia population (3.3%) (personal communication, Epidemiology Branch, Department of Health, Western Australia; 2009).

Characteristics of Indigenous and non-Indigenous cases are compared in Table 1. There was no difference in age or gender distribution, but Indigenous cases were more likely to be treated with antiviral medications (73% vs 41%, $P < 0.01$) and to be hospitalised (27% vs 10%, $P < 0.01$). There was no difference in the overall frequency of having 'any underlying medical condition or risk factor', but Indigenous cases were significantly more likely to be smokers or to have diabetes, heart disease, or renal disease, compared with non-Indigenous cases. Symptomatology was broadly similar between the two groups, although Indigenous cases were more inclined to report respiratory symptoms, while non-Indigenous cases reported significantly higher frequencies of non-respiratory symptoms including myalgia, headache, diarrhoea and vomiting.

As shown in Table 2, the age difference between hospitalised and non-hospitalised Indigenous cases was nearly 18 years. Among Indigenous cases, those hospitalised had higher frequencies of each individual underlying medical condition, smoking and pregnancy, compared with those not hospitalised. Sixty-three per cent of hospitalised cases reported two or more medical conditions or risk factors, compared with only 7% of those not hospitalised ($P < 0.01$) (Table 2).

Univariate logistic regression analysis for the total study population showed that being Indigenous conferred a significantly higher risk of hospitalisation resulting from pH1N1 infection (OR = 3.2, 95% CI 1.7–5.8), as did age (OR = 1.03, 1.02–1.04) (where 1.03 is the increase in odds per year of age); having any pre-existing medical condition or risk factor (OR = 5.9, 3.5–10.1); diabetes (OR = 4.1, 2.1–7.9); heart disease (OR = 6.4, 3.0–13.7); respiratory disease (OR = 2.3, 1.4–3.5); obesity (OR = 3.2, 1.8–5.8); and two or more medical conditions or risk factors (OR = 7.6, 4.7–12.1).

When the above factors were entered into a stepwise multivariate logistic regression model for all cases, only 2 factors were independent predictors of hospitalisation: having two or more medical conditions or risk factors (OR = 4.9, 95% CI = 2.9–8.2, $P < 0.001$) and age (OR = 1.02, 1.01–1.03, $P = 0.006$).

Discussion

This study has found that Indigenous West Australians with pH1N1 were 3.2 times more likely to be hospitalised than their non-Indigenous peers, which is similar to the rate ratio of hospitalisation reported by Flint et al[4] for the Northern Territory (3.4), and to that reported for the Maori population in New Zealand (3.0).[3] Not surprisingly, compared with non-Indigenous pH1N1 cases, Indigenous people with pH1N1 infection reported a higher prevalence of several underlying medical conditions known to be a risk for worse outcomes from influenza, including diabetes, heart disease,

Table 1: Characteristics of Indigenous and non-Indigenous pandemic (H1N1) 2009 influenza cases, Western Australia, 2009

	Indigenous	Non-Indigenous	*P* value*
Number	**63**	**793**	
Male	35/63 (56%)	397/793 (50%)	NS
Mean age, years (range)	26.0 (1–78)	26.0 (0–85)	NS
Antivirals administered for treatment	46/63 (73%)	325/792 (41%)	<0.01
Vaccinated in 2009 for seasonal influenza	16/50 (32%)	162/673 (24%)	NS
Underlying medical conditions and risk factors			
Any existing medical condition (includes pregnancy and smoking)	32/58 (55%)	323/680 (48%)	NS
Diabetes	10/58 (17%)	35/670 (5%)	<0.01
Heart disease	6/57 (11%)	24/667 (4%)	0.01
Respiratory condition	13/57 (23%)	158/671 (24%)	NS
Renal disease	3/57 (5%)	8/667 (1%)	0.02
Obesity	6/57 (11%)	54/671 (8%)	NS
Pregnancy	2/60 (3%)	33/758 (4%)	NS
Smoker	13/58 (22%)	80/670 (12%)	0.02
Other medical conditions†	7/57 (12%)	22/668 (3%)	<0.01
Multiple medical conditions or risk factors‡	13/58 (22%)	95/680 (14%)	NS
Symptoms			
Influenza-like illness	55/63 (87%)	640/793 (81%)	NS
Cough	61/63 (97%)	674/793 (85%)	<0.01
Pyrexia	42/63 (67%)	440/793 (56%)	NS
Sore throat	39/63 (62%)	442/793 (56%)	NS
Dyspnoea	21/63 (33%)	260/793 (33%)	NS
Coryza	31/63 (49%)	461/793 (58%)	NS
Fatigue	41/63 (65%)	588/793 (74%)	NS
Myalgia	31/63 (49%)	523/793 (66%)	<0.01
Rigors	30/63 (48%)	433/793 (55%)	NS
Headache	31/63 (49%)	503/793 (63%)	0.02
Diarrhoea	5/63 (8%)	155/793 (20%)	0.02
Vomiting	12/63 (19%)	268/793 (34%)	0.02
Outcomes			
Hospitalisation	17/63 (27%)	83/793 (10%)	<0.01
Median number of days hospitalised (range)	4 (2–7)	4 (2–69)	NS

* Pearson χ^2 test; t-test for age and number of days hospitalised.

† Other conditions include neurological diseases, blood disorders, metabolic disorders, and immune system disorders.

‡ Multiple conditions includes two or more of the above listed conditions (includes smoking).

NS Not significant.

Numbers and percentages shown, unless otherwise stated.

and renal disease, and also had a higher prevalence of cigarette smoking. These findings reflect a large body of evidence documenting a greater chronic disease burden in the Indigenous population of Australia.[8,9]

Indigenous persons requiring hospitalisation for pH1N1 infection were on average 18 years older than non-hospitalised cases, and had higher frequencies of most individual chronic medical conditions and risk factors that were examined, including obesity, pregnancy and smoking. Notably, 63% of Indigenous hospitalised cases reported more than one underlying medical condition or risk factor for adverse influenza outcome, as opposed to only 7% of non-hospitalised cases.

Significantly, only age and the presence of two or more medical conditions or risk factors were shown to be independent predictors of hospitalisation

Table 2: Characteristics of Indigenous cases, by hospitalisation status

	Non-hospitalised	Hospitalised	*P* value*
Number	46	17	
Male	27/46 (59%)	8/17 (47%)	NS
Mean age, years (range)	21.2 (1–73)	39.0 (2–78)	0.01
Antivirals administered for treatment	31/46 (67%)	15/17 (88%)	NS
Vaccinated in 2009 for seasonal influenza	13/38 (34%)	3/12 (25%)	NS
Any existing medical condition (includes pregnancy and smoking)	19/42 (45%)	13/16 (81%)	0.01
Pregnancy	1/44 (2%)	1/16 (6%)	NS
Diabetes	3/42 (7%)	7/16 (44%)	<0.01
Heart disease	2/41 (5%)	4/16 (25%)	0.03
Respiratory condition	6/41 (15%)	7/16 (44%)	0.02
Renal disease	1/41 (2%)	2/16 (12%)	NS
Obesity	2/41 (5%)	4/16 (25%)	0.03
Smoker	7/42 (17%)	6/16 (37%)	NS
Other medical conditions†	5/41 (12%)	2/16 (12%)	NS
Multiple medical conditions or risk factors‡	3/42 (7%)	10/16 (63%)	<0.01

* Pearson χ^2 test; t-test for age.

† Other conditions include neurological diseases, blood disorders, metabolic disorders, and immune system disorders.

‡ Multiple conditions includes two or more of the above listed conditions (includes smoking).

NS Not significant.

Numbers and percentages shown, unless otherwise stated

for pH1N1 infection, with Indigenous status not contributing further. This suggests that Indigenous Australians suffered higher rates of pH1N1 hospitalisation only by virtue of their higher prevalence of risk factors for severe disease, rather than due to any innate genetic predisposition or vulnerability.[10]

The finding that Indigenous pH1N1 cases were more likely to have received treatment with antiviral medication is almost certainly due to the prioritisation of antiviral medication to those in the community with influenza-like illness or confirmed pH1N1 infection who were recognised to be at increased risk of severe illness, which included people with underlying medical conditions and Indigenous Australians, and those requiring hospitalisation.[11,12] Reflecting the latter recommendation, 88% of hospitalised Indigenous cases received antiviral treatment.

The differences in the reported symptomatology of pH1N1 infection are interesting, with Indigenous cases more likely to report respiratory symptoms and non-Indigenous cases reporting systemic symptoms more frequently. This may be due to a higher rate of respiratory complications in Indigenous cases, contributing to the higher rate of hospitalisation observed. However, the possibility that the difference reflects cultural differences in reporting cannot be discounted.

There are several potential limitations to this investigation. Previous analyses have demonstrated that the interviewed and non-interviewed pH1N1 cases were very similar, excepting that a higher proportion of hospitalised cases were not interviewed.[7] It is possible that non-interviewed hospitalised cases may have been more unwell, and have had higher prevalence of risk factors for severe disease, but were this so, it is likely that inclusion of such cases would only strengthen the reported findings. Indigenous pH1N1 cases were also relatively under-represented in the study group compared with all notified cases but this is unlikely to have introduced significant bias to these comparisons.

In addition, as this was an investigation of pH1N1 cases detected as a result of healthcare attendance in the community, there was no control over which cases presented and were tested for pH1N1. It is recognised that a significant proportion of pH1N1 cases had asymptomatic or mild infection,[13] so cases identified by health-care attendance and testing are likely to have a higher prevalence of underlying medical conditions and adverse outcomes than the true population infected with the virus. The underlying medical conditions and clinical manifestation data analysed in this investigation were also self-reported, and as such, may be subject to some inaccuracy.

In summary, Indigenous Western Australians with pH1N1 infection were more likely to be hospitalised and had a significantly higher prevalence of underlying medical conditions and risk factors for adverse outcomes of influenza infection, compared with non-Indigenous cases. However, after accounting for age and the presence of two or more co-morbidities and risk factors, Indigenous status did not confer additional risk for hospitalisation for pH1N1 infection. This study highlights the need to ensure that preventative measures, especially influenza vaccination, are delivered as widely as possible among those with chronic medical conditions and risk factors for adverse outcomes of influenza infection.[14]

Acknowledgements

We thank the participants, the public health nurses who conducted the telephone interviews, and the laboratory staff who identified and notified the cases.

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