West Nile Virus

The Buzz on Ottawa Residents' Awareness, Attitudes and Practices

Samantha D. Wilson, MHSc

Monali Varia, MHSc

Lee Y. Lior, MD, MSc

on behalf of the Field Epidemiology Summer Course

ABSTRACT

Background: In 2002, the City of Ottawa was interested in the public perception of West Nile Virus (WNV) and mosquito control. Their objectives were to assess: awareness of WNV, practices to reduce mosquito sources, personal protective measures, and attitudes towards community-based insecticide programs.

Methods: In July 2002, we administered a telephone survey to a random, stratified sample of urban, suburban and rural Ottawa households.

Results: Surveys were completed for 491 households. Most (77.2%) respondents reported they had heard of WNV, and of these, 58.3% reported WNV was an important health issue. Mosquito repellent was the most common personal protective measure, reported among 72.5% of respondents, of whom 76.9% used DEET products. Multivariate regression analyses showed that age was a significant predictor of repellent use, with respondents aged less than 51 years more likely to use repellent than older respondents ($OR_{adj} = 2.0$; 95% CI: 1.2-2.3). This age group was also more likely to use at least one personal protective behaviour ($OR_{adj} = 2.5$; 95% CI: 1.4-4.5).

Of 315 people selecting a justified time to larvicide, 4.8% chose "larvicides should never be used in Ottawa"; 33.4% stated that larviciding would be appropriate "when WNV was detected in birds or mosquitoes"; one third "needed more information" on the health and environmental effects of insecticides, prior to selecting a response.

Conclusions: Our findings highlight the need for public education reinforcing WNV importance, emphasizing the health and environmental effects of insecticides as well as appropriate personal protective behaviours. Such messages should target older and urban residents.

MeSH terms: West Nile Virus; health behaviour; health surveys; mosquito control; public health

La traduction du résumé se trouve à la fin de l'article.

Canadian Field Epidemiology Program, Public Health Agency of Canada

Correspondence: Samantha D. Wilson, Oxford County Public Health and Emergency Services, 410 Buller St., Woodstock, ON N4S 4N2 Tel: 519-539-9800, E-mail: swilson-clark@county.oxford.on.ca

Reprint requests: Dr. Lee Lior, Canadian Field Epidemiology Program, Public Health Agency of Canada, 3rd Floor, Room 351B, 130 Colonnade Rd., Ottawa, ON K1A 0K9

Field Epidemiology Summer Course (group members): Zahid Abbas, MBBS, MPH, Canadian Field Epidemiology Program, Public Health Agency of Canada; Lisa Belzak, MHSc, Centre for Surveillance Coordination, Public Health Agency of Canada; Frank Bovell, MD, MSc, FRCPC, Section of Infectious Diseases, Department of Medicine, University of Manitoba; Rita Finley, BSc, Foodborne, Waterborne and Zoonotic Infections Division, Public Health Agency of Canada; Ying Jiang, MSc, Cancer Division, Public Health Agency of Canada; Marcus Lem, MD, MHSc, FRCPC, Canadian Field Epidemiology Program, Public Health Agency of Canada; Paul MacPherson, MD, PhD, Division of Infectious Diseases, Ottawa Hospital and Ottawa Health Research Institute; E. Jane Parmley, DVM, Department of Population Medicine, Ontario Veterinary College, University of Guelph; Leila Srour, MD, MHSc, FRCPC, Canadian Field Epidemiology Program, Public Health Agency of Canada

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West Nile Virus (WNV) is an emerging infectious disease affecting birds and mammals. Birds are primary reservoir hosts; mammals (including humans) are incidental hosts. Transmission occurs mainly through mosquito bites.¹ In 1999, WNV first arrived in North America, in the United States.² In August 2001, WNV-infected birds were identified in Ontario.³ The first Canadian human case was identified in Ontario in August 2002; in that year, there were 329 confirmed cases, including 20 deaths.⁴ With no vaccine against WNV and no specific treatment for the disease, preventing exposure to disease-carrying mosquitoes remains the primary intervention. This can be achieved by reducing the mosquito population and undertaking personal protective measures.

Larvicides and adulticides are insecticides used to reduce the mosquito population.^{5,6} Larviciding includes applying chemical or bacterial agents to mosquito breeding areas to inhibit mosquito larvae from maturing. Adulticiding is applying chemicals by aerial dispersion to kill adult mosquitoes. While the risks and benefits of these agents for the prevention of mosquito-borne infections are well documented, their perceived environmental impact remains controversial.^{7,8} Other mosquito-control measures include eliminating breeding sites.

Personal protective behaviours include limiting exposure to mosquitoes during peak mosquito activity, wearing protective clothing (long sleeves, light colours) and using insect repellent containing N,N-diethyl-meta-toluamide (DEET).

With WNV activity in Ontario, the City of Ottawa Public Health and Long Term Care Branch was interested in the community's perception of WNV. We surveyed Ottawa residents about their awareness of WNV, practices to reduce mosquito sources, use of personal protective measures and their level of self-perceived risk for WNV that justifies the use of insecticides. This paper summarizes our key findings.

METHODS

Households, randomly selected from Select Phone® (Canadian Edition 2002, ProCD), were stratified using forward sortation area into urban, rural and suburban

* Strata are defined in relation to the National Capital Region Greenbelt

Source: City of Ottawa, 2001; Cartography by Public Health Agency of Canada Centre for Surveillance Coordination

Figure 1. City of Ottawa Residence by Urban, Suburban, and Rural Strata

residence in relation to the National Capital Region Greenbelt, a greenspace surrounding the urban core.⁹ Households within the Greenbelt were designated urban; those immediately outside and adjacent to the Greenbelt, suburban; and those furthest away, rural (Figure 1). One thousand phone numbers from each geographic area were randomly selected and distributed evenly among interviewers.

The Public Health Agency of Canada's Field Epidemiology Summer Course 2002 participants developed and administered a structured, pilot-tested questionnaire by telephone between July 5th and 8th, 2002. Inclusion criteria were: a household within Ottawa, a respondent 18 years of age or older who could communicate in English or French and provided verbal consent. Exclusion criteria included business or fax numbers.

Questions addressed WNV knowledge, personal protective behaviours (PPB),

mosquito source-reducing practices, and self-perceived levels of risk that justify community-wide insecticide application. To estimate exposure to mosquitoes, information on time spent outdoors during peak mosquito activity (dawn and dusk) was collected: "low" exposure corresponded to "never" or "rarely" spending time outdoors; "medium" to spending time outdoors "some days"; and "high" to spending time outdoors "most days" or "nearly every day". Participants were asked about what repellent they utilize, on themselves and/or their children, to reduce exposure to mosquitoes; responses were categorized into DEET and non-DEET containing products.

To identify levels of self-perceived risk that justify community-based insecticide use for mosquito control, we asked when the City of Ottawa should use 1) larvicides, and 2) adulticides in the community: before WNV was detected in the com-

munity (lowest level); when an infected mosquito or bird was identified locally; when a local human case became ill or died; or, larvicide and/or adulticides should never be used (highest level). Participants could elect not to select a response if they required more information.

Data were entered using EpiData 2.1a.¹⁰ Descriptive analyses were conducted using EpiInfo 6.04d.¹¹ Chi-square or Fisher's exact tests (for expected values less than five) were used for bivariate analysis. The statistical significance of the difference between proportions was estimated using 95% confidence intervals in EpiCalc 2000.¹² Justification for insecticide use was weighted to provide population-based estimates. Variables significant in bivariate analysis were examined by backwards, stepwise multivariate logistic regression, using SPSS 11.5.1 to examine two outcomes: using insect repellent, and using at least

TABLE I
Characteristics of Survey Respondents

Characteristic	n (%)
Age (N=480)	
18-30	69 (14.4)
31-40	115 (24.0)
41-50	143 (29.8)
51-60	75 (15.6)
≥61	78 (16.2)
Sex (N=487)	
Male	209 (42.9)
Female	278 (57.1)
Education Attained (N=471)	
High School	109 (23.1)
College	156 (33.1)
University	206 (43.7)
Residence Location (N=491)	
Urban	154 (31.4)
Suburban	161 (32.8)
Rural	176 (35.8)

one PPB (avoiding time spent outdoors, wearing long sleeves and pants, wearing light-coloured clothing).¹³

RESULTS

Participants

Overall, 47.3% (491/1037) of contacted households completed the survey. Forty-four (4.2%) households did not meet the inclusion criteria; 48.4% (502/1037) refused to participate. Refusal rate did not vary by location.

Demographic characteristics are reported in Table I. Over half (53.8%) were aged 31 to 50 years, with more female (57.1%) than male respondents. Most respondents (76.9%) had post-secondary education; one third (33.7%) had young children (12 years or younger) residing in the household.

Awareness and attitudes

Overall, 77.2% (379/491) of respondents had heard of WNV, with 91.0% (345/379) citing radio, newspaper or television as their information source. Just over half (221/379) cited WNV was an important health issue and most (353/379) knew how WNV is transmitted to humans.

Awareness and attitudes of respondents are reported in Table II. A significantly higher proportion of respondents with some post-secondary education had heard about WNV than those who had, at most, high school education (81.2% vs. 67.9%; 95% CI: 3.1-23.5). University-educated respondents were less likely to report WNV as an important health issue. Compared to urban respondents, a significantly higher proportion of rural respon-

TABLE II
Awareness and Attitudes of Respondents Towards WNV

	n (%)	Difference [95% CI]
Had heard of WNV (N=490)		
Education		
High school	74 (67.9)	Ref*
College	121 (77.6)	9.7% [-2.0, 21.4]
University	172 (83.9)	16.0% [5.2, 26.8]
Sex		
Female	204 (73.6)	Ref
Male	174 (83.3)	9.7% [2.0, 17.4]
Residence		
Urban	107 (69.5)	Ref
Suburban	125 (78.1)	8.6% [-1.7, 18.9]
Rural	147 (83.5)	14.0% [4.3, 23.7]
Felt WNV was an important issue (N=346†)		
Education		
High school	48 (72.7)	Ref
College	84 (76.4)	3.7% [-10.9, 18.3]
University	82 (51.3)	21.4% [7.1, 35.7]
Sex		
Female	131 (69.3)	Ref
Male	89 (57.1)	12.2% [1.4, 23.0]
Residence		
Urban	56 (57.1)	Ref
Suburban	74 (64.3)	7.2% [-6.9, 21.3]
Rural	91 (68.4)	11.3% [-2.2, 24.8]

* Reference

† Individuals responding "Don't know" were excluded from analysis

TABLE III
Personal Protective Behaviours and Source Reduction Practices

	n (%)
Personal Protective Behaviours (N=491)	
Use of repellent	356 (72.5)
Going indoors	210 (42.8)
Long sleeves/pants	102 (20.8)
Swat/smack/slap	143 (29.1)
Light-coloured clothing	10 (2.0)
Intact screens	382 (77.8)
Source Reduction (N=294)	
Draining of items	213 (72.4)

Note: Response categories not mutually exclusive

dents had heard of WNV. While more men had heard of WNV, they were less likely to report that WNV was an important health issue. WNV knowledge and awareness did not vary by age group.

Personal protective behaviours (PPB) and source reduction

Exposure to mosquitoes during peak biting times ranged from 62.9% (309/491) reporting "high", 21.6% (106/491) "moderate" and 15.1% (74/491) "low" exposures. Rural respondents reported significantly higher exposures than suburban residents (69.9% vs. 56.5%; 95% CI: 2.6-24.2).

The most common PPB and mosquito source-reduction practices are reported in Table III. Seventy-three percent (356/491) of respondents applied repellent on themselves and 74.5% (123/165) on their children. Significantly fewer respondents aged 51 years and older used repellent compared

to younger respondents (62.1% vs. 77.7%; 95% CI: 6.2-25.0). Urban respondents were less likely to use insect repellent than suburban (63.0% vs. 77.6%; 95% CI: 4.0-25.2) and rural respondents (63.0% vs. 76.1%; 95% CI: 2.6-23.6). Respondents with no post-secondary education were also less likely to use repellent compared to those with post-secondary education (61.5% vs. 76.5%; 95% CI: 4.3-25.7).

Of the 356 respondents who applied insect repellent, 76.9% (n=274) reported using DEET products while 16.3% (n=58) did not know what they used. Of the 123 respondents applying repellent on their children, 74.8% (n=92) used DEET products. Compared to suburban respondents, significantly fewer urban respondents used DEET products on themselves (67.0% vs. 80.8%; 95% CI: 1.3-26.3).

Multivariate regression analyses of predictors for repellent use revealed that younger respondents (less than 51 years)

were more likely than older respondents to use repellent ($OR_{adj}=2.0$; 95% CI: 1.2-2.3). Persons less than 51 years were also more likely to use at least one PPB ($OR_{adj}=2.5$; 95% CI: 1.4-4.5).

We asked about common mosquito breeding sites around homes: 60.1% (294/489) had items outdoors that collect water. Of these, 72.4% ($n=213$) reported draining those items “regularly”. Those with no post-secondary education were significantly less likely than university-educated respondents to regularly drain such items (60.9% vs. 77.7%; 95% CI: 1.7-31.9). While almost all respondents had screens on all their windows, 22.2% (109/491) reported torn screens.

Larvicide and adulticide use

Overall, 315 participants selected a level of perceived risk that would justify larviciding for mosquito control (Table IV). Since most (80.1%) respondents indicated a similar level for both larvicide and adulticide use, only larvicide levels are reported here. Similarly, responses did not vary geographically, so overall responses are presented. Five percent of Ottawa residents felt that larvicides should never be used in Ottawa, and 33.4% required more information comparing the human, animal and environmental effects of insecticides with the risks associated with WNV before selecting a justification level for larviciding.

DISCUSSION

With the first human case of WNV in Ottawa identified in 2003, this survey provides current data about WNV awareness, attitudes and practices in Ottawa. While personal protective behaviours are an effective means of limiting exposure to mosquitoes, awareness of WNV, its transmission, and personal perception of risk are critical prevention strategies.

In our survey, nearly one quarter of respondents had not heard of WNV and 41.7% of those did not feel it was an important health issue, particularly urban respondents. These findings illustrate the need to educate the general public about WNV.

We found that older respondents were significantly less likely to use insect repellent for self-protection compared to all other age groups, similar to observations in

TABLE IV

Reported Level of Self-perceived Risk for Larvicide Use

Level	n (%) [*]
Before WNV is found (lowest level)	96 (19.3%)
WNV in birds/mosquitoes	163 (33.4%)
Human case / death	35 (7.5%)
Never use larvicides (highest level)	21 (4.8%)
Don't know / No response	7 (1.6%)

^{*} Weighted by area of residence

other studies.¹⁴ This population warrants targeted public health messages as they may be at increased risk for WNV sequelae.^{15,16}

In our survey, fewer urban residents reported using DEET-containing repellent than their suburban and rural counterparts. Urban residents may perceive they have fewer mosquitoes in their environment, which could translate to a perception of decreased risk of WNV infection. Public health messages about the risk of WNV and the appropriate use of DEET-containing products, including their use on children (as recommended by the Canadian Paediatric Society¹⁷), should target the urban population.

Intact window and door screens can reduce indoor exposure to mosquitoes. Most respondents reported screened windows, consistent with findings in New York and Connecticut.^{14,18} However, our results indicate that one fifth of Ottawa households had torn screens, reducing their value as mosquito barriers.

Our findings also show that 27.6% of respondents did not routinely drain items that collect water around their homes. While similar to findings by McCarthy et al. where few residents actively incorporated mosquito source-reduction measures, educational campaigns should encourage Ottawa residents to eliminate mosquito breeding habitats to decrease the risk of WNV transmission.¹⁴

Ottawa residents agreed that larviciding and adulticiding should be used for mosquito control when WNV is detected in birds or mosquitoes in Ottawa, however, such justification for action must be interpreted cautiously. We found that one third of those surveyed wanted more information about the health and environmental effects of larvicides and adulticides. Ottawa's 2004 West Nile Virus Control Plan recommends consideration of larviciding and adulticiding in areas at high risk for an outbreak of human disease. Prior to

implementation, residents should be provided with information on the health and environmental effects of insecticides to ensure public understanding and support for such initiatives.

Our study limitations include potential selection bias introduced through the telephone survey. The study was conducted over a July weekend when residents at greater risk for mosquito exposure may have been outdoors and not included in the survey. However, the demographic distribution of our respondents corresponded to Ottawa's population, suggesting that our generalizations are well founded.¹⁹ It is also possible that geographical misclassification of households may have occurred. Households on either side of the Greenbelt may experience similar mosquito exposure but were classified differently (suburban vs. urban). Since the City of Ottawa required information based on their relation to the Greenbelt, our geographic determination is pertinent for Ottawa, but may not be generalizable to other jurisdictions. Since we did not assess the frequency of repellent application, our results may overestimate true protection. All non-DEET containing products were grouped, even though some – such as soybean oil, citronella, lavender oil and P-menthane3,8-diol – are approved for use by Health Canada. Therefore the proportion of those using “effective” repellents may be underestimated. While the health and environmental impacts of larvicides are different from those of adulticides, this difference did not emerge in our results, suggesting a need for public education on the differences, risks and benefits of various mosquito control strategies. Finally, we did not include non-English or non-French speaking residents, whose awareness, attitudes and practices may be different.

The findings of this survey emphasize the need for public education, especially regarding West Nile Virus awareness, with an emphasis on personal protective behav-

ious. Improved and targeted public health messages, and the ongoing evaluation of such interventions, are key to minimizing the impact of West Nile Virus.

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RÉSUMÉ

Contexte : En 2002, la ville d'Ottawa a voulu connaître la perception du public sur le virus du Nil occidental (VNO) et la lutte contre les moustiques. Les objectifs étaient d'évaluer : la sensibilisation au VNO, les pratiques utilisées pour réduire les sources de moustiques, les mesures de protection personnelles et les attitudes face aux programmes communautaires d'application d'insectifuges.

Méthode : En juillet 2002, nous avons réalisé une enquête téléphonique auprès d'un échantillon stratifié de ménages choisis au hasard en milieu urbain, en banlieue et en milieu rural.

Résultats : Quatre cent quatre-vingt-onze (491) ménages ont répondu à l'enquête. La plupart des répondants (77,2 %) ont déclaré être au courant de l'existence du VNO, et pour 58,3 % de ceux-ci, le VNO représente une question de santé importante. L'application d'un insectifuge est la mesure de protection personnelle la plus répandue, puisque 72,5 % des répondants affirment y avoir recours. Les produits à base de DEET sont utilisés par 76,9 % de ces derniers. Les analyses de régression multiples montrent que l'âge est un prédicteur important de l'utilisation d'insectifuges : les répondants de moins de 51 ans sont plus susceptibles d'utiliser un insectifuge que les répondants plus âgés ($RC_{\text{corrigé}} = 2,0$; IC de 95 % = 1,2-2,3). Ce groupe d'âge est aussi plus susceptible d'adopter au moins un comportement de protection personnelle ($RC_{\text{corrigé}} = 2,5$; IC de 95 % = 1,4-4,5).

Des 315 personnes qui ont choisi un moment propice à l'application de larvicides, 4,8 % croient que les larvicides ne devraient jamais être utilisés à Ottawa, 33,4 % pensent qu'il serait approprié d'utiliser un larvicide si le VNO était détecté dans des oiseaux ou des moustiques, et le tiers des répondants considèrent qu'ils ont besoin de renseignements supplémentaires sur les effets des insectifuges sur la santé et l'environnement avant de répondre.

Conclusions : Nous concluons qu'il y a lieu de renforcer la sensibilisation du public à l'importance du VNO et d'insister sur les effets des insectifuges sur la santé et l'environnement, ainsi que sur les comportements de protection personnelle. Les messages devraient cibler les personnes âgées et celles qui demeurent en milieu urbain.