CITIZENS HEALTH PROTECTION BEHAVIOUR AGAINST VECTOR BORN DISEASES IN GREECE: THE CASE OF XANTHI

Lambros TSOURGIANNIS[1], Despoina CHATZIPANAGIOTOU[1], Loukas GEORGIOU[2], Kyriakos PAVLIDIS[1] and Valentin DISLIAN[3]

[1]Directorate of Public Health and Social Care of Regional District of Xanthi, Region of Eastern Macedonia and Thrace, Xanthi, Greece, ltsourgiannis@gmail.com
[2] General Directorate of Public Health and Social Care of Region of Eastern Macedonia and Thrace, Komotini, Greece,
[3]4th Sanitary Region of Macedonia and Thrace, Xanthi, Greece

Abstract: During the period of 2012-2014 a West Nile Virus (WNV) outbreak occurred in the Regional District of Xanthi in Greece. As the self-protection measures are the most important for securing the public health this paper aims to explore the citizens buying behavior towards those measures, to classify them into groups and to profile each group accordingto their demographic characteristics. Age, education, number of children, number of family members, occupation and infection from WNV found to be significant related to people expenses towards self-protection measure. Moreover, people that have been infected from WNV have different demographic profile than those who have not being infected.

Key words*: West Nile Virus, Consumers attitudes towards self-protection measures against mosquitoes, Buying behavior towards mosquito repellents.*

JEL Classification Codes: I12, I18, M31.

1. INTRODUCTION

Mosquito born diseases are an important public health problem. Anopheles, Aedes and Culex are commonly seen in Greece. Generally, mosquito vectors are solely responsible for transimitting malaria, dengue, West Nile virus, chikungunyua, Japanese encephalitis, lympathic filariasis (Rosendaal 1997, Raghavendra *et al* 2011, Pandit *et al.* 2010). In particular, West Nile Virus (WNV) outbreak occurred in the Region of Eastern Macedonia and Thrace in 2012-2015. WNV infection can be asymptomatic or symptomatic in humans, with 4:1 ration (Center of Disease Control and Prevention (2015). This virus is transmitted by mosquitoes and can cause illness which can me mild resulting in influenza – like symptoms or severe affecting the central nervous system causing encephalitis (Lorono-Pino *et al.* 2014; Jones *et al.* 2014). In many WNV outbreaks reported deaths (Jones *et al.* 2014; He *et al.* 2014). Hence, WNV not only possess risk to health but diseases in endemic areas place a burden on households, on health services and the economic growth of the local communities (Koenraadt *et al.* 2006). WNV not only possess risk to health but diseases in endemic areas place a burden on households, on health services and the economic growth of the local communities (Tyagi *et al.* 2005). Therefore, citizens protection against mosquito bites is very important for *public* health.

Application of insecticides consists of the primary control tool in most of vector control programs throughout the world since early eighteen century (*Breman* 2001, Raghavendra *et al* 2011), use of chemicals to control insects dates back to classical period in Ancient Greece and Rome according to Raghavendra *et al* (2011). Nowadays studies have revealed that citizens

knowledge, attitude, and practice of various methods of personal and household protection against mosquito bites vary in different endemic regions of tropical countries (Pandit *et al.* 2010). Various methods for protection from mosquito bites are used globally including repellent oils, smoldering coils, vaporizing mats, repellent creams, liquid vaporizer (Raghavendra *et al* 2011). The market in these products worldwide is worth about 2 billion USD per year (WHO, 1998). Effectiveness of these methods lasts between five to seven hours with 60-80% protection (Curtis *et. al.* 1989, Ansari *et al* 1990). Synthetic pyrethroids including allethrin, bioallethrin and related chemicals used in these repellents are generally safe for human health but their prolonged use might be dangerous (Lui *et al.* 1987; Raghavendra *et al* 2011). Oils extracted from plants are used for repelling mosquitoes in some countries (Raghavendra *et al* 2011). Moreover, smoke produced by burning neem oil mixed in kerosene in lamps had also shown protection from mosquito bites whilst mats impregnated with neem oil are found effective in repelling mosquitoes (Sharma *et al.* 1993a,b; Sharma and Ansari 1994).

Besides, one of the most important of vector born disease control program is to raise awareness about mosquito bites prevention in general community. Hence many efforts have been made worldwide to educate citizens about the danger of mosquito bites. The motivation is the effective control of the infectious diseases transmitted by the inset particularly mosquito (Pandit *et al.* 2010).

Prevention of the disease through better knowledge and awareness is the appropriate way to keep disease away. Studies referring to knowledge, attitudes and practices (KAP) showed that community contributes significantly in circumventing malaria problem, take vigorous action and spend a substantial amount of money on insecticide consumer products to kill mosquitoes in dengue endemic areas [3].

Jones *et al.* (2004) argued that fumigation was perceived the most effective method for preventing dengue in Acapulco Guerro in Mexico whilst collective community preventing activities including clean up campaigns, destruction of breeding sites and information sharing identified very important. The use of personal or household protection methods are indicators of socioeconomic status, which has been reported as an important factor associated with diseases transmitted by mosquitoes and more particular with malaria (Tyagi *et al*. 2005). They also argued that the high usage of mosquito repellents by urban respondents and the low usage in rural respondents is explained the impact of socioeconomic conditions on the selection of protection means in communities (Tyagi *et al*. 2005). Moreover, education and knowledge of protection from mosquito bites, the promotion of health education and the positive role of women and family members in community interventions must be emphasized, is associated with less malaria infection (Tyagi *et al*. 2005; He *et al.* 2014). Another study aimed to identify the association between demographic characteristics (including age, sex, education, occupation, sub-district), knowledge of the population on symptoms of dengue, vector and prevention against mosquitoes; and practices such as container protection and mosquito reduction (Koenraadt *et al.* 2006).

On the other hand, as 63 cases infected by WNV nursed in the hospital in the Regional District of Xanthi in Greece with medical cost of 71,162.10 euros during 2012-2015, and 3 deaths reported, it is crucial to understand the buying behavior of people towards self-protection measures against mosquitoes as well as to explore the factors/characteristics affecting such behaviour in order the stakeholders to develop the necessary informative and awareness campaign for the use of such measures.

2. METHODOLOGY

A survey was implemented to explore people's buying behavior towards self-protection measures against mosquitoes (more particularly the self-protection measures this study examines is repellents) and to profile them regarding their demographic characteristics as well as to explore the association between people infection from WNV and their expenses for self-protection measures against mosquitoes, and the relationship between citizens infection from WNV and their demographic characteristics (Figure 1).Therefore this study examines the rejection of the following research null hypotheses:
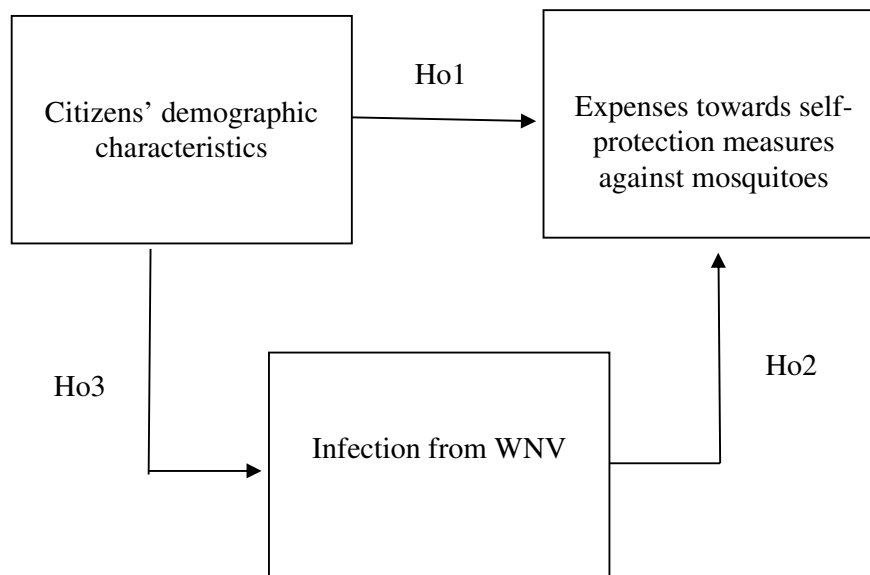
Figure 1: The Conceptual Model

Therefore, this study examines the rejection of the following research null hypotheses:
Ho1: The purchasing behaviour towards self-protection measures against mosquitoes of consumers is not significantly related to their demographic characteristics.
Ho2: The purchasing behaviour towards self-protection measures against mosquitoes of consumers that have not been infected from WNV is different from those have been infected from WNV
Ho3: Infected from WNV consumers have not different demographic profile than those who have not been infected.

The survey of the study addressed to a sample of citizens in order to gather data necessary to explore their purchasing behaviour towards self-protection measures against mosquitoes and to identify the demographic characteristics that affect their behaviour. Information were gathered through a telephonic interview survey as people are familiar with this kind of research and their educational level is suitable for the use of this kind of survey method (Oppenheim 2000).

The questionnaire of this survey contains sixteen questions organized into four sections: (a) the first section includes five questions regarding the demographic characteristics, (b) the second section contains three questions regarding epidemiological data of the respondents who have been infected from WNV, (c) the third section through four questions aims to explore the medical cost of the infected cases and (d) the fourth section that includes five questions regarding the self-protection measures people use against mosquitoes.

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Characteristic that affect citizens purchasing behaviour towards self-protection measures against mosquitoes were identified by the researchers after searching the literature. Furthermore, they designed a questionnaire in order to meet the research objectives and pre-tested it in academics, experts and consumers. In the next stage the questionnaire was piloted in July of 2015 to 40 consumers. The pilot survey indicated that no modification needed to the questionnaire and therefore the main survey was conducted in September – October of 2015 as mentioned above.

The productive sample consists of 314 people from the Regional District of Xanthi that would be reasonably representative of some larger population about which useful generalization could be made. The representativeness of the sample immunized by checking the proportion of the consumers of the sample who declared that bought goods for their self-protection against mosquitoes with those of the pilot survey following Siardos methodology [8]. In particular, the proportion of consumers (p) in the pilot survey who indicated that bought repellents for self-protection against mosquitoes is 92%. Therefore, in order to achieve a representative sample the sample size should be 265 consumers (in order have z=3 and d=5%). Hence the researchers decided to a sample size of 340 consumers and the proportion of consumers purchased items for self-protection against mosquitoes in this sample is about 92% (314 consumers), the sample is considered representative.

Firstly, citizens were classified into two groups according to the amount they spend monthly for repellents against mosquitoes: (a) people that spend more money (≥50 euros) comprising the 6% of the sample and (b) people that spend less money (<50 euro) comprising the 94% of the sample. Moreover, binary logistic regression analysis was performed in order to identify which of the demographic characteristics mainly affect citizens purchasing behaviour towards self-protection measures against mosquitoes. Besides consumers classified into five groups according to their buying behavior towards self-protection measures against mosquitoes: (i) those who spend less than 20 euro per month consisting of 72% of the sample, (ii) those who spend between 21-50 euros consisting of the 22 % of the sample, (iii) those who spend between 51-70 euros comprising the 4% of the sample, (iv) those who spend between 71-100 euros comprising the 1.3% of the sample and (v) those who spend more than 100 euros for repellents consisting of the 0.7% of the sample. Next, chi-square analysis conducted to explore the association between the amount citizens spend for self –protection measures against mosquitoes and their demographic characteristics. Furthermore, chi-square analysis performed to identify the association between citizens' infection from WNV and the amount they spend for self-protection methods against mosquitoes as well as their demographic characteristics.

3. RESULTS

Binary logistic regression analysis indicated that the existence of one to two children has a positive impact to people on spending more than 50 euros per month for self – protection measures against mosquitoes (Table 1).

Table 1: impact of the demographic characteristics on the expenses for self-protection measures against mosquitoes

	B	S.E	Wald	df	Sign	Exp(B)
Infected by WNV	-2.037	1.284	2.515	1	n.s	0.130
Number of Children existed in family			8.459	3	0.037	
No children	-0.482	1.433	0.113	1	n.s	0.618
1 -2 children	2.178	1.070	4.144	1	0.042	8.827
>=3 children	-0.404	0.930	0.189	1	n.s	0.668

Family members			3.464	4	n.s	
1 member	-0.645	1.298	0.247	1	n.s	0.525
2 members	-0.918	1.190	0.595	1	n.s	0.399
3 members	0.032	1.125	0.001	1	n.s	1.032
>=4 members	1.439	1.269	1.285	1	n.s	4.216
Occupation			6.412	7	n.s	
Private employee	17.797	5109.378	0.000	1	n.s	53572670.21
Free licensed /Businessman	19.319	51109.378	0.000	1	n.s	245487931.1
Students	-0.044	27024.223	0.000	1	n.s	0.957
Civil servant	18.756	14746.249	0.000	1	n.s	139772144.1
Farmer	18.586	5109.378	0.000	1	n.s	117943443.5
Retiree	16.778	5109.378	0.000	1	n.s	19347779.61
Unemployed	15.884	5109.378	0.000	1	n.s	7911150.552
Education			1.928	3	n.s	
Primary School	-0.927	0.980	0.896	1	n.s	0.396
High School	-0.512	0.854	0.359	1	n.s	0.599
Undergraduate / post graduate degree	-0.568	0.998	0.324	1	n.s	1.765
Age			9.043	5	n.s	
<30years	-21.319	7629.164	0.000	1	n.s	0.000
31-40	-4.077	1.796	5.155	1	n.s	0.017
41-50	-2.482	1.733	2.053	1	n.s	0.084
51-60	-21.645	5117.354	0.000	1	n.s	0.000
>=61	0.123	0.981	0.016	1	n.s	1.131
Constant	-16.226	5109.378	0.000	1	n.s	0.000
-2Log likehood =	137.421	Cox & Snell R^2=	0.051	Nagelkerke R^2 =		0.131
Hosmer and Lemeshow Test						
x^2 = 11.184	df=8	P=0.192				

Chi- square analysis indicated (Table 2) that most of the people in the Regional District of Xanthi in Greece who spend less than 20 euro per month for self-protection measures against mosquitoes have not been infected by WNV, are more than 61 years old, have two children, their household is consisting of two members, are on retirement and attended the primary school. Most of the people who spend between 21-50 euro per month for such expenses have not been infected by WNV, are mainly between 31-40 years old, with two children, their family has four members, are civil servants and finished the high school. The majority of citizens who spend between 51-70 euro have not been infected by WNV, are 41-50 years old, have one child, their family has three members, they are civil servants and hold a university degree. Consumers who spend between 71-100 euro for buying goods for self-protection against mosquitoes have not been infected by WNV, are middle aged, with two children, three family members, mainly civil servants and finished the high school. Most of the people who spend between 101-150 euro for those expenditures have not been infected by WNV, are more than 61 years old, they have 1-2 children; they live alone, are on retirement and attended the primary or high school. Finally, most of the consumers who spend more than 151 euro for those expenditures have been infected by WNV. They are more than 71 years old, with 1 or more than 3 children, their family is consisting of two to three people, are mainly farmers and attended the primary school.

Hence **Ho1:** *Consumers' purchasing behaviour towards towards self-protection measures against mosquitoes is not significantly related to their demographic characteristics* can be rejected.

Table 2: Profiling consumers regarding their demographic characteristics

Demographic characteristics	Expenses for self-protection measures against mosquitoes					
	<20	21-50	51-70	71-100	101-150	>151
Age (x^2=43.091 df=25, P<0.014)						
<30	11.5%	6.1%	0.0%	0.0%	0.0%	0.0%
31-40	17.3%	28.8%	28.6%	0.0%	0.0%	0.0%
41-50	13.7%	27.3%	42.9%	50.0%	0.0%	0.0%
51-60	15.5%	15.2%	0.0%	25.0%	0.0%	0.0%
61-70	20.4%	15.2%	21.4%	0.0%	50.0%	0.0%
>71	21.7%	7.6%	7.1%	25.0%	50.0%	100.0%
Total	100%	100%	100%	100%	100%	100%
Number of children (x^2=29.098, df=15, P=0.016)						
No chidren	24.3%	9.1%	7.1%	0.0%	0.0%	0.0%
1child	10.6%	21.2%	42.9%	25.0%	50.0%	50.0%
2 children	49.6%	51.5%	35.7%	75.0%	50.0%	0.0%
>=3 children	15.5	18.2%	14.3%	0.0%	0.0%	50.0%
Total	100%	100%	100%	100%	100%	100%
Family members (x^2=52.760 df=20, P<0.001)						
1 member	18.2%	4.6%	0.0%	0.0%	100%	0.0%
2 members	32.9%	18.5%	21.4%	0.0%	0.0%	50.0%
3 members	17.8%	24.6%	57.1%	0.0%	0.0%	50.0%
4 members	21.8%	33.8%	14.3%	50%	0.0%	0.0%
>=5members	9.3%	18.5%	7.1%	50%	0.0%	0.0%
Total	100%	100%	100%	100%	100%	100%
Occupation (x^2=61.213, df=35, P=0.004)						
Private employee	12.4%	18.5%	21.4%	0.0%	0.0%	0.0%
Free licensed	8.4%	16.9%	21.4%	50.0%	0.0%	0.0%
Businessmen	0.4%	1.5%	0.0%	0.0%	0.0%	0.0%
Student	4.9%	0.0%	0.0%	0.0%	0.0%	0.0%
Civil servant	10.72%	23.1%	35.7%	0.0%	0.0%	0.0%
Farmer	14.2%	6.2%	21.4%	25.0%	0.0%	100.0%
Retiree	31.9%	23.1%	0.0%	25.0%	100%	0.0%
Unemployed	17.7%	10.8%	0.0%	0.0%	0.0%	0.0%
Total	100%	100%	100%	100%	100%	100%
Education (x^2=33.502, df=15, P=0.004)						
Primary School	41.2%	19.7%	21.4%	25.0%	50.0%	100.0%
High School	32.3%	40.9%	7.1%	75.0%	50.0%	0.0%
Technical Education	6.2%	16.7%	21.4%	0.0%	0.0%	0.0%
Undergraduated / postgraduate degree	20.4%	22.7%	50.0%	0.0%	0.0%	0.0%
Total	100%	100%	100%	100%	100%	100%

Table 2 indicates that the vast majority of consumers (94.7%) that have not been infected by WNV spend less than 200 euros for buying goods for self-protection against mosquitoes. On the other hand the proportion of citizens who spend more than 51 euros is much higher for those who have been infected by WNV than those that have not been infected (25% contrary to 6.0%).

Table 3: The association between consumers expenses for self-protection and infection by WNV

Infection by WNV (x^2=43.582, df=5, P=0.0.001)	Expenses for self-protection measures against mosquitoes					
	<20 euro	<21-50 euro	51-70 euro	71-100 euro	101-150 euro	>151 euro
No	94.7%	22.1%	4.0%	1.3%	0.7%	0.0%
Yes	75.0%	0.0%	12.5%	0.0%	0.0%	12.5%

Hence **Ho2**: *Consumers' expenses for self-protection measures against mosquitoes is not significant related with their infection from WNV* may be rejected.

Chi- square analysis indicated (Table 4) that most of the people in the Regional District of Xanthi in Greece who have not been infected from WNV are less than 51 years old, their families have more than three members, most of them are private employees or civil servants and some of them free licenced, and finished the high school or hold a university degree. On the other hand, most of the infected from WNV people are quite old, their families are consisting of one or two members, are mainly farmers and attended the primary school.

Table 4: Profiling consumers who have been infected and have not been infected from WNV regarding their demographic characteristics

Demographic characteristics	Infected from WNV	
	NO	YES
Age (x^2=53.215 df=5, P<0.001)		
<30	10.1%	0.0%
31-40	20.8%	0.0%
41-50	19.1%	0.0%
51-60	15.4%	0.0%
61-70	19.5%	12.5%
>71	15.1%	87.5%
Total	100%	100%
Family members (x^2=10.619 df=4, P<0.031)		
1 member	14.2%	25.0%
2 members	27.4%	56.3%
3 members	21.3%	12.5%
4 members	25.3%	0.0%
>=5members	11.8%	6.3%
Total	100%	100%
Occupation (x^2=93.812, df=7, P=0.001)		
Private employee	14.5%	0.0%
Free licensed	11.8%	0.0%
Businessmen	0.7%	0.0%
Student	3.7%	0.0%
Civil servant	14.5%	0.0%
Farmer	9.1%	93.8%
Retiree	30.0%	6.3
Unemployed	15.8%	15.8%
Total	100%	100%
Education (x^2=24.619, df=3, P=0.001)		
Primary School	32.9%	93.8%
High School	35.2%	0.0%
Technical Education	9.4%	0.0%
Undergraduated / postgraduate degree	22.5%	6.3%
Total	100%	100%

Hence, **Ho3:** *Infected from WNV consumers have not different demographic profile than those who have not been infected* may be rejected.

4. DISCUSSION - CONCLUSIONS

This study investigated the main demographic characteristics that affect the buying behaviour of people towards the self – protection measures against mosquitoes. It showed that the amount consumers' spend for buying goods for self-protection against mosquitoes is mainly affected by the existence of children, age, number of family members, education and occupation. Hence this study supports the arguments of other study that socioeconomic conditions are associated with self-protection measures against mosquitoes. Furthermore, this study indicated that the people expenses towards self-protection methods against mosquitoes are significantly related to their infection from WNV. Besides, people who have been infected from WNV have different demographic profile in comparison with people who have not been infected.

A limitation however of this survey needs to be mentioned. The adopted statistical methodology although it explored the factors that affect consumers' buying behaviour, which is useful for marketing analysis and strategy development cannot measure the demand of a product or determine the importance of the characteristics of a product that affect consumers' behaviour. These measurements can be made with the use of other statistical techniques such as conjoint analysis and contingent valuation.

Nevertheless, the current study is of value, since according to the knowledge of the authors, this is the first attempt to explore the consumers' attitudes towards the self – protection measures against mosquitoes, as well the main factors that affected their attitudes. According to the results of the study and the epidemiological studies conducted by the Directorate of Public Health and Social Care of Regional District of Xanthi the vast majority of the people who infected in the Region of EMTh by WNV were mainly old retiree with low or no use of self – protection measures. According to the results of the current study, most of the people who spend less than 20 euro per month per household for self-protection against mosquitoes are mainly old (more than 61 years old, low educated, retiree, with two people in their family) and these people mainly consist of the population who are mainly infected by WNV. Therefore, a systematic prevention informative and awareness campaign by the relative stakeholders (Region of Eastern Macedonia and Thrace, Municipalities, Ministry of Health) should aim to these target group in order to start use self-protection measures and in long term a reduction in cases infected by WNV in the area and a reduction in medical cost to take place.

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