

public health and the economy. Suffolk County, New York (NY) has one of the highest incidences in NY State affecting primarily the Hispanic/Latino population working in gardening, landscaping, and agriculture (field workers). However, there is a paucity of research among this population. Thus, the aim of this longitudinal study was to assess the current seroprevalence and seroconversion of the *Borrelia burgdorferi* infection and its risk factors such as sociodemographic, symptoms, tick encounter, and use of the Fatigue Severity Scale, associated with seropositivity in the Hispanic/Latino immigrant worker population of Eastern Suffolk County.

Methods. Recruitment of participants was based on several towns of this County. Following signed informed consent, participants completed a questionnaire and had their blood drawn. Samples were tested using the conventional 2-tiered serological testing for Borreliosis.

Results. Between June 2016 and October 2018, 660 (83.5%) completed Visit 1; 58.8% of them completed elementary school or less, and 56.7% reported earning = or <\$20,000 annually, 344 were field workers, from which, 82.3% and 55.2% were male and from Guatemala, respectively. The overall seroprevalence was 7.2% (48/660) but was significantly higher among gardener/landscapers (11.5%) having an adjusted odds ratio (OR) = 2.02 with a CI = 1.02–4.03. Another significant risk factor was experiencing fevers after a tick-bite (Adjusted OR: 2.08, CI:1.42–5.63). 2.7% (8/292) seroconverted and were gardener/landscaper.

Conclusion. Several barriers to healthcare access, health literacy, and prevention were identified. Gardening/landscaping has an occupational risk in this population. Efforts to educate about tick-borne infections and preventive methods such as vaccinations are warranted for this population.

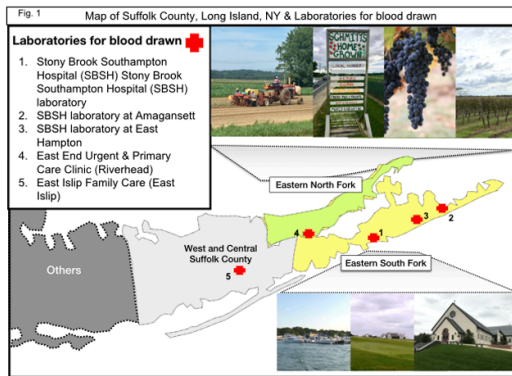


Figure 1- Legend: Suffolk County is divided into three regions representing differences in landscape. The Eastern North Fork mostly contains vineyards and farms, while the Eastern South Fork contains accommodations for beach attractions. The West and Central Suffolk County is the most commercial corridor including retail trade, manufacturing, construction, health care, professional service, research and technical service, etc.

Fig 2 Participants and Seropositive cases throughout years and visits 1 & 2

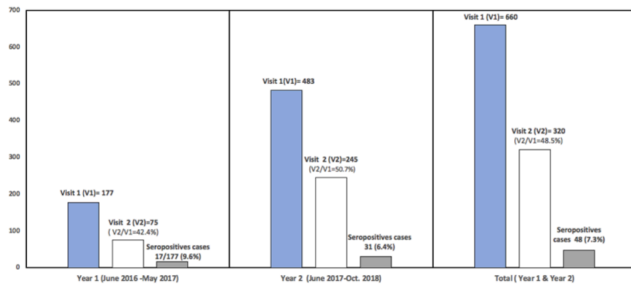


Figure 3 - Legend: The number of participants in Visit 1 (V2), Visit 2 (V1), and the seropositive cases in Year 1 and Year 2.

Table 1. Seroprevalence of *Borrelia burgdorferi* among Hispanic/Latino immigrant workers in the Eastern End of Suffolk County, New York (N=660)

	%	(N/N)	Odds Ratio (CI)**	
			Unadjusted associations p value	Adjusted Association β (p value)
Overall prevalence	7.2	(48/660)		
Prevalence among occupational groups:				
Non-outdoors workers	2.8	(5/181)		
Outdoor workers	9	(43/479)	* 0.006	0.623 (0.24) 1.846 (0.658-5.27)
* Non-Field workers	3.48	(11/316)		
* Field workers	10.75	(37/344)	* 0.046	0.699 (0.76) 2.012 (0.93-4.34)
- Gardener/Landscapers	11.5	(32/278)	* 0.000	0.706 (0.44) 2.026 (1.02-4.03)
- Non-Gardeners/Landscapers	4.2	(16/382)		
- Agriculture/Vineyard/Farm workers	7.7	(5/65)		
- Non-Agriculture/Vineyard/Farm workers	7.22	(43/595)		

* Chi-square (Fisher Exact Test) in a univariate analysis ** CI: Confidence interval

Table 2: Risk Factors with seropositivity to *Borrelia burgdorferi* in Hispanic/Latino immigrant workers in Suffolk county, NY

Risk Factors	Seropositive cases	Seronegative cases	Pearson Chi-Square
Socio-demographic & Tick exposure			
- Age	42.35 +/-10.03	38.39 +/-10.93	p=0.011 (*)
- Occupation:			
- Outdoors worker	43/48 (89.6%)	436/612 (71.2%)	p=0.006
- Field worker	37/48 (77.1%)	307/612 (50.2%)	p=0.000
- Gardener/landscaper	32/48 (66.7%)	246/612 (40.2%)	p=0.000
- Agriculture worker/Vineyard worker	5/48 (10.4%)	60/612 (9.8%)	p=0.891
- Living in Eastern Long Island?	46/48 (95.8%)	539/612 (87.3%)	p=0.103
- South Fork	20/48 (58.3%)	256/612 (58.2%)	p=0.982
- North Fork	26/48 (45.8%)	283/612 (58.8%)	p=0.289
- Education: Have only elementary School or less	34/48 (70.8%)	354/612 (57.8%)	p=0.078
- Estimate annual income equal or less than \$ 20,000	21/48 (56.3%)	353/607 (58.2%)	p=0.052 (**)
- Years living/working in Long Island	12.87 +/-8.09	11.321 +/-9.44	p=0.218 (***)
- Have seen a tick on themselves or had a tick-bite this or last summer	45/48 (93.8%)	454/584 (77.7%)	p=0.538
- Estimated range of 1-5 ticks seen on themselves this or last summer	35/45 (77.8%)	396/454 (87.2%)	p=0.062 (***)
- Remove tick from their body their hands	40/45 (88.3%)	412/612 (67.3%)	p=0.021
- Have pets at home	4/48 (8.3%)	144/612 (23.5%)	p=0.015
- Know what Lyme disease before today	15/48 (31.3%)	206/612 (33.7%)	p=0.733
- Use repellent working or going outdoors	16/48 (33.3%)	207/612 (33.8%)	p=0.945
- Use clothes treated with permethrin (outdoors)	0/48 (0%)	37/612 (6%)	p=0.08
Medical History			
- Previous non-communicable disease (a, b, c)	Yes: 13/48 (27.1%)	Yes: 192/612 (31.4%)	p=0.536
a. High cholesterol	Yes: 12/48 (25%)	Yes: 140/612 (22.9%)	p=0.736
b. Hypertension	Yes: 7/48 (14.6%)	Yes: 70/612 (11.4%)	p=0.513
c. Diabetes	Yes: 2/48 (4.2%)	Yes: 34/612 (5.6%)	p=0.683
- Previous communicable disease			
a. Lyme disease	Yes: 9/48 (19.1%)	Yes: 71/612 (11.6%)	p=0.144
b. Other tick-borne disease	Yes: 8/48 (16.7%)	Yes: 27/612 (4.4%)	p=0.000
Fatigue Severity Scale (FSS)			
- FSS Score ≥ 4	16/48 (33.3%)	174/612 (28.4%)	p=0.47
Clinical questions:			
- Symptoms Score (mean +/- SD)	2.45 +/- 2.3	1.99 +/- 2.02	p=0.072 (*)
a. Do you usually have muscle pain?	Yes: 24/48 (50%)	Yes: 223/612 (36.4%)	p=0.062
b. Do you usually have joint pain?	Yes: 24/48 (50%)	Yes: 234/612 (38.2%)	p=0.108
c. Do you usually have stiff neck?	Yes: 14/48 (29.2%)	Yes: 160/612 (26.1%)	p=0.647
d. Do you feel fatigue most of the time?	Yes: 20/48 (41.7%)	Yes: 200/612 (33%)	p=0.221
e. Have you ever had swollen knee	Yes: 8/48 (16.7%)	Yes: 110/612 (18%)	p=0.820
f. Have you ever had facial paralysis	Yes: 2/48 (4.2%)	Yes: 28/612 (4.6%)	p=0.896
g. Have you ever had a rash after a tick-bite?	Yes: 16/48 (33.3%)	Yes: 153/612 (25%)	p=0.203
h. Have you ever had fever after a tick-bite?	Yes: 17/48 (35.4%)	Yes: 77/655 (13.6%)	p=0.000

(*) Student's t-tests (***) Some participants didn't want to give this data (**) Mann Whitney U Test

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1646. Education Level is Associated with Tetanus Vaccine Coverage: Results from the 2016 BRFSS

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Background. Vaccination coverage among US adults for tetanus, a potentially fatal disease, continues to be lower than the national goals. Education has been considered to have positive impact on vaccination coverage. However, recently there have been outbreaks of vaccine preventable conditions in areas with high college completion rates. This study aims to assess the relationship between education and vaccination coverage. Specifically, we looked at the association between education level and tetanus vaccination status of the US adults.

Methods. Data from the 2016 Behavioral Risk Factor Surveillance System, a self-reported annual survey for non-institutionalized adults in the United States from the Centers for Disease Control, were analyzed. The outcome was up-to-date tetanus coverage (within the last 10 years) defined by the response to: *have you received tetanus vaccine since 2005?* Education was stratified into four categories: (1) grade 11 or less, (2) grade 12/GED, (3) college 1–3 years, and (4) college 4 or more years. Bivariate analyses and multivariable logistic regression were conducted on the analytic sample (n = 417,473) using Stata 15, accounting for weighting and the complex survey design of the BRFSS.

Results. This study identified that 59.9% of US adults are up-to-date on the tetanus vaccine status (Table 1). Higher education level was found to be associated with increased odds of up to date tetanus vaccination. The highest odds were for those with 4 or more years of college education [aOR = 1.31; 95% CI: 1.26–1.35] while the lowest odds were for those less than grade 11 education, when compared with those with a high school degree [aOR = 0.93; 95% CI: 0.88–0.98] (Figure 1). Other covariates identified as negatively associated with up-to-date tetanus status were race/ethnicity, female sex, unemployment, not being married, not having insurance or a personal healthcare provider, and being above 45 years of age (Figure 1).

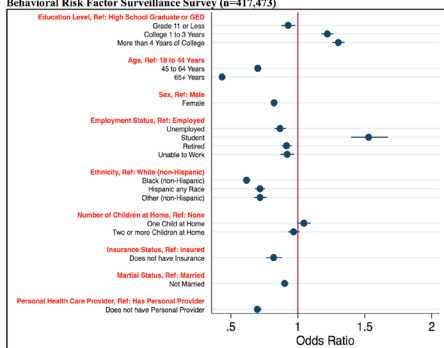
Conclusion. This study identified a positive association between up-to-date tetanus status and higher education level. Introducing community-specific vaccination education

programs for those without tertiary education, especially for those above age 45 and without insurance, may help increase the overall vaccination status in the United States.

TABLE 1: U.S. Adults by up-to-date Tetanus Status (received Tetanus vaccine with in the last ten years), 2016 Behavioral Risk Factor Surveillance Survey (n=417,473)

	No. did not receive tetanus since 2005 Weighted % (n) 40.1% (n=172,474)	Yes, received tetanus since 2005 Weighted % (n) 59.9% (n=244,999)	P-Value
Education Level			
Grade 11 or less	49.7%	50.3%	
Grade 12 or GED	43.5%	56.5%	
College 1 year to 3 years	37.3%	62.7%	
College 4 years or more	34.9%	65.1%	p < 0.001
Age			
Age 18 to 44	34.6%	65.4%	
Age 45 to 64	40.6%	59.4%	
Age 65 or older	51.7%	48.3%	p < 0.001
Sex			
Male	37.8%	62.2%	
Female	41.4%	58.6%	p < 0.001
Race/Ethnicity			
White (Non-Hispanic)	36.9%	63.1%	
Black (Non-Hispanic)	48.2%	51.8%	
Hispanic (Any Race)	45.8%	54.2%	
Other (Non-Hispanic)	40.8%	59.2%	p < 0.001
Employment Status			
Employed	36.7%	63.3%	
Unemployed	45.0%	55.0%	
Student	27.0%	73.0%	
Retired	49.4%	50.6%	
Unable to Work	44.9%	55.1%	p < 0.001
Number of Children in House			
0	41.7%	58.3%	
1	36.6%	63.4%	
2 or more	37.7%	62.3%	p < 0.001
Insurance Status			
Yes	39.1%	60.9%	
No	48.0%	52.0%	p < 0.001
Marital Status			
Married	38.7%	61.3%	
Not Married	41.9%	58.1%	p < 0.001
Personal Health Care Provider			
Yes	38.9%	61.1%	
No	44.2%	55.8%	p < 0.001

FIGURE 1: Adjusted Odds* of up-to-date Tetanus Status among U.S. Adults: 2016 Behavioral Risk Factor Surveillance Survey (n=417,473)



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1647. Investigating Parents' Vaccine Hesitancy in the United Arab Emirates: A Cross-Sectional Survey

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Background. Vaccine hesitancy has been declared by the World Health Organization as a top threat to public health in 2019. It has been studied extensively in the Western world but not so among Arabs. The Parent Attitudes about Childhood Vaccines (PACV) survey is a validated instrument for identifying vaccine-hesitant parents; however, Arabic version is not available. This study aimed to assess the reliability of the PACV survey in Arabic language and to determine the prevalence of vaccine hesitancy among parents in the United Arab Emirates (UAE).

Methods. Forward and backward translation of the PACV in Arabic language was carried out. The reliability of the Arabic-PACV survey was tested among parents with children. The same survey was used to study vaccine hesitancy among parents attending seven primary healthcare centers in Al-Ain city, UAE. Univariate analyses were performed to determine the associations between vaccine hesitancy and socio-demographic characteristics.

Results. The Cronbach's alpha (a measure of internal consistency reliability) for total Arabic-PACV scores was 0.79. Two hundred and sixty-two participants answered the PACV survey (response rate, 74.9%). The majority were mothers (75.9%) in the age group (18–39 years) and more than half (56.3%) had attended university or higher education. Only 29 parents (11.1%, 95% CI = 7.85–15.5) were found to be vaccine-hesitant (score ≥ 50). Socio-demographic characteristics such as education level, number of children and household income did not have any significant association with vaccine hesitancy. However, when using the question “Have you ever decided not to have your child get a shot for reasons other than illness or allergy?” as a surrogate item for vaccine hesitancy, the variable education was significantly associated to this question. More specifically, participants with lower education (n = 110) were more likely to be vaccine-hesitant compared with those with higher education (n = 147), (OR = 4.50, P = 0.026, 95% CI = 1.3–20.7).

Conclusion. The Arabic-PACV survey could serve as a tool in the evaluation of vaccine hesitancy among parents in UAE and other Arabic-speaking countries. The

prevalence of vaccine hesitancy among parents in our community is comparable with other populations.

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1648. Prevalence of *Orientia tsutsugamushi*, *Anaplasma phagocytophilum*, and *Leptospira interrogans* in Striped Field Mice in Gwangju, Republic of Korea

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Background. Scrub typhus, anaplasmosis, and leptospirosis are well-known diseases that are considered common, widespread rodent-borne infectious diseases

Methods. This study investigated the prevalence of *Orientia tsutsugamushi*, *Anaplasma phagocytophilum*, and *Leptospira interrogans* in wild rodents through molecular detection using organ samples and through serological assay using blood samples of mice collected from two distinct sites in Gwangju Metropolitan City, Republic of Korea (ROK).

Results. A total of 47 wild rodents, identified as *Apodemus agrarius* (*A. agrarius*), were captured from June to August 2016. The seroprevalence of antibodies against bacterial pathogens in *A. agrarius* sera was analyzed; 17.4% (8/46) were identified as *O. tsutsugamushi* through indirect immunofluorescence assay and 2.2% (1/46) were identified as *Leptospira* species through passive hemagglutination assay. Using polymerase chain reaction, the spleen, kidney and blood samples were investigated for the presence of *O. tsutsugamushi*, *A. phagocytophilum*, and *L. interrogans*. Out of the 47 *A. agrarius*, 19.1% (9/47) were positive for *A. phagocytophilum* and 6.4% (3/47) were positive for *L. interrogans*, while none were positive for *O. tsutsugamushi*. Four out of 46 (8.7%) blood samples, six out of 45 (13.3%) spleen samples, and one out of 47 (2.1%) kidney samples were positive for *A. phagocytophilum*. Three out of 47 (6.4%) kidney samples were positive for *L. interrogans*. The sequencing results of PCR positive samples demonstrated >99% similarity with *A. phagocytophilum* and *L. interrogans* sequences

Conclusion. *A. phagocytophilum* was mostly detected in the spleen, whereas *L. interrogans* was mostly detected in the kidneys. Notably, *A. phagocytophilum* and *L. interrogans* were detected in *A. agrarius* living in close proximity to humans in the metropolitan suburbs. The results of this study indicate that rodent-borne bacteria may be present in wild rodents in the metropolitan suburban areas of ROK

Table 1. Nucleotide sequences and PCR conditions for the detection of rodent-borne bacteria in the rodent tissues

Bacteria	Target gene	Primer name	Nucleotide sequence (5'-3')	Product size (bp)	Denaturation	Annealing	Extension	PCR profile (°C)	Reference
<i>ms</i>		os-16dF1	AGGAGATAATGAC	199	94/60	57/30	72/45	36	In this study
		os-16dR1	AGTACCTACAG						
		os-16dR2	CCCTACCAACCTCA						
<i>Orientia tsutsugamushi</i>		56B0-144F	YGGAGATCTCTCCG	1250	94/60	60/60	72/60	35	In this study
		56B0-144R	CTTGG						
		56B0-1393R	AGCTACCCCTCACC						
		56B0-409F	CCWCTGACCTACT	680	94/30	61/30	72/45	30	
		1088R	ATKATGC						
		GR0607F	GAAGATGCGWGTGG	688	93/30	54/30	72/60	30	[12]
<i>gmsZ</i>		GR01294R	AGGCGCTTCWCTTCW						
		GR0677F	ATFACTCAGAGTGTCT	445	93/30	57/30	72/60	30	
		GR01211R	CTCARTG						
<i>Anaplasma phagocytophilum</i>		ANP-F1	GANGAATFACACCT	705	93/30	53/30	72/60	35	[13]
		ANP-R1	CCTGAG						
		ANP-F2	TTGACCGCTGAAGCA	664	93/30	52/30	72/60	5	
<i>Legionella pneumophila</i>		legp1-435F	GGGAAACGATGAGM	1435	94/60	56/60	72/60	35	In this study
		legp1-1870R	TTG						
		legp1-1870R	GTTTATAGAGGTTGA						
<i>L. pneumophila</i>		L-legp1-217F	CCGTGATTTTCTCAAC	848	94/30	58/20	72/45	30	[14]
		L-legp1-218R	TAAGG						
		L-legp1-218R	CAGATFACCTTAGTCGC						
<i>Legionella pneumophila</i>		legp1-218R	GTGAG						
		legp1-218R	GTGAG						