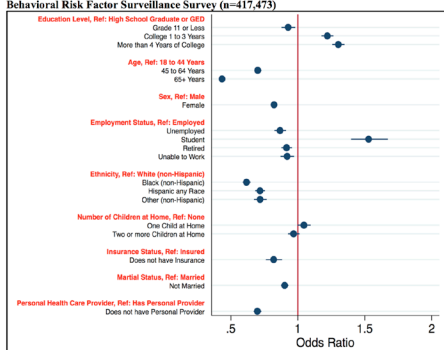programs for those without tertiary education, especially for those above age 45 and without insurance, may help increase the overall vaccination status in the United States.

	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)

*The model was adjusted for sex, age, race, employment, insurance status, children in household, marital status, and personal health care provider.

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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 (11.11%, 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.

Disclosures. **All authors:** No reported disclosures.

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 suburbans. 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	cycles	Reference
Orientia tsutsuga-mushi	rrs	ot-16sRF1	AGGGATGATAATGAC AGTACCTACAG	199	94:60	57:30	72:45	36	In this study
		ot-16sRR1	CCTCTACCATACTCTA GCCTAACAG						
	56 kDa	56BO-144F	YGYAGAATCTRCTCG CTTGG	1250	94:60	60:60	72:60	35	In this study
		56BO-1395R	AGCTAMCCCTRCACC AABAC						
		56BO-406F	CCWCCTCARCCTACT ATRATGC	680	94:30	61:30	72:45	30	
		56BO-1088R	GCWGCTGCTRCTGCT TCTTG						
Anaplasma Phagocyto-hilum	groEL	GRO607F	GAAGATGCWGTWGG WTGTACKGC	688	95:30	54:30	72:60	30	[12]
		GRO1294R	AGMGCTTCWCCTTCW ACRTCYTC						
		GRO677F	ATTACTCAGAGTGCTT CTCARTG	445	95:30	57:30	72:60	30	
		GRO1121R	TGCATACCRTCAGTYT TTTCAAC						
	ankd	ANK-F1	GAAGAAATTACAACT CCTGAAG	705	95:30	53:30	72:60	35	[13]
		ANK-R1	CAGCCAGATGCAGTA ACGTG						
		ANK-F2	TTGACCGCTGAAGCA CTAAC	664	95:30	52:30	72:60	5	
		ANK-R2	ACCATTTGCTTCTTGA GGAG		95:30	54:30	72:60	25	
Leptospira interrogans	rpoB	rpoB-1889F	GTTCCAACATGCAAC GYCAR	1649	94:60	52:60	72:60	35	In this study
		rpoB-3537R	GTTGAAGGATTCRGG RATAC						
		rpoB-2438F	TYATGCCKTGGGAAG GWTAC	1023	94:30	56:30	72:45	30	
		rpoB-3460R	GCATRTCRTCKGACTT GATG						
	LipL32	hap1-435F	GGGAATACGTAGAMG TTCG	1435	94:60	56:60	72:60	35	In this study
		hap1-1870R	GTTTATAGTAGGTTGA AGCTTG						
		L-hap1-217F	CCGTGATTTTCCTAAC TAAGG	848	94:30	58:20	72:45	30	[14]
		L-hap1-218R	CAGATTACTTAGTCGC GTCAGA						
	gyrB	LeptoB2F	TGAGCCAAGAAGAAA CAAGCTACA	500	94:30	59:30	72:45	35	[15]
		LeptoB504R	MATGGTTCCRCTTTCC GAAGA						

Table 2. Rate of positive bacterial infections in 46 *A. agrarius* rodents as indicated by serological assays.

Name of positive sera	Seropositive	
	IFA titer for *O. tsutsugamushi*[a] (% positive rate)	PHA for *Leptospira* species[b] (% positive rate)
6-6	1:128	–[c]
6-7	1:64	–
7-4	1:16	–
7-13	1:16	–
7-17	1:16	1:160
7-18	1:32	–
8-7	1:256	–
8-9	1:64	–
No. of positive sera	8 (17.4)	1 (2.2)

[a]Cutoff titer of immunofluorescence assay, immunoglobulin G ≥ 1:16,
[b]Cutoff for passive hemagglutination assay ≥ 1:80,
[c]–: negative.

Table 3. Number of positive cases of *Orientia tsutsugamushi*, *Anaplasma phogocytophilum*, and *Leptospira interrogans* among the 47 *Apodemus agrarius* rodents obtained by PCR targeting different genes.

Specimen	No. of samples	*O. tsutsugamushi*			*A. phagocytophilum*		*L. interrogans*		
		rrs[a]	TSUTSU Kit[b]	56 kDa[c]	groEL[d]	ankA[e]	rpoB[f]	LipL32[g]	gyrB[h]
Blood	46	0	0	0	4	4	0	0	NA[i]
Spleen	45	0	0	0	0	6	0	0	NA
Kidney	47	0	0	0	0	1	3	2	2
No. of positive rodents		0			9 (19.1)[j]		3 (6.4)		

[a]16S ribosomal RNA,
[b]INNOPLEX TSUTSU detection kit for *O. tsutsugamushi*,
[c]56 kDa gene,
[d]Heat shock protein chaperone,
[e]Ankyrin-related protein gene,
[f]RNase polymerase subunit beta,
[g]Outer membrane lipoprotein,
[h]DNA gyrase subunit B,
[i]NA: not available,
[j]% Positive rate.

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1649. That's Not Cricket! Outbreak of *Legionella pneumophila* (*L. pneumophila*) in a Community Cricket Club in the UK, 2018: Challenges in *Legionella* Control in This Setting

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Background. Cricket clubs in the UK are frequently collocated with community venues which host a range of activities, often for vulnerable members of society, such as children and elderly people. In July 2018, two cases of local laboratory-confirmed Legionnaires' disease were notified to Public Health England (PHE). The cases were found to be players in the same cricket team (via the enhanced Legionnaires' disease surveillance system) and had multiple shared potential exposures during their incubation periods.

Methods. A three-pronged outbreak investigation was conducted, with epidemiological, microbiological, and environmental components. Case-finding and potential shared exposures were identified through completion and analysis of *Legionella* enhanced surveillance questionnaires. Following risk assessment, environmental samples were obtained from aerosolizing outlets at identified sites. Additionally, sputum and urine samples were obtained from cases. All samples were sent to the PHE reference laboratory for confirmation of species and sequence typing.

Results. All cases were confirmed as *L. pneumophila* serogroup 1. Only one case provided a sputum sample suitable for sequence typing, which yielded a partial result. This result was consistent with a strain of *L. pneumophila* found in abundance at numerous water outlets at a local cricket club epidemiologically linked to all cases. On the emergence of these findings, control measures were put in place to prevent further exposure to the pathogen including shot-dosing of the water systems and closure of aerosolizing outlets. However, eradication of the organism proved challenging.

Conclusion. This is the first known outbreak of *L. pneumophila* epidemiologically and microbiologically linked to a cricket club in the UK. Control of the outbreak was challenging for two reasons. Firstly, the nature of the setting as a community venue meant that there was a large number of people potentially exposed, many with characteristics putting them at increased risk of Legionnaires' disease. Secondly, the cricket club was run by a committee of volunteers with limited expertise and financial resource. There was a resultant lack of clarity about who was ultimately responsible for *Legionella* risk management and the implementation of control measures.

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1650. Knowledge and Attitudes Toward Influenza Vaccination Among Hispanics: A Survey Conducted in Latin American Consulates in South Florida

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Background. Each year Influenza causes between 12,000 and 56,000 deaths, and over half a million of hospitalizations in the United States. Despite the widespread availability of vaccination, immunization coverage is low. Less than half of American adults receive the influenza vaccine, and there is a disparity between Hispanic and non-Hispanics, with only 35.9% of Hispanic compared with 45.9% of white non-Hispanics receiving the vaccine. In Miami, South Florida, over two-thirds of the population is Hispanic, and rates of influenza vaccination are low. This study aims to identify the knowledge and attitudes toward influenza vaccination among members of the adult Hispanic community in Miami, and to identify barriers to vaccination in this population.

Methods. This is a cross-sectional study conducted during the influenza season in 2017 and 2019 (October to December). A survey was administered in the waiting rooms of participating Latin American Consulates (Argentina, Colombia, Ecuador, Guatemala, Honduras, Mexico, Peru, and Uruguay) in Miami. Participants included were older than 18 years, Hispanic, and with residence in the United States for more than 6 months. The participants accepted the inform consent orally. The survey was voluntary and anonymous.

Results. We enrolled 970 adults. The median age was 43 years, 50% were male, 60% had health insurance, and 67% had completed education of high school or higher. Knowledge regarding influenza and vaccination was low (78% believed asymptomatic individuals could transmit influenza, 14% knew that vaccination is recommended during the winter months, 50% felt not everyone should be vaccinated, 25% believed the vaccine causes influenza, and 7% autism). About one quarter (27%) received the influenza vaccine annually, 35% sometimes, and 38% never. Using multinomial logistic regression, we identified age $\chi^2(2) = 19.38$, $P < 0.001$, consulate $\chi^2(6) = 160.21$, $P < 0.001$, and insurance status $\chi^2(2) = 23.04$, $P < 0.001$ as predictors of receiving vaccination. Neither gender, nor education level found to be associated with vaccination behavior.

Conclusion. Immunization rates in the adult Hispanic population are low. Interventions to improve vaccination among Hispanics who are older and lack of health insurance are urgently needed in the diverse Hispanic community.

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1651. The Impact of the 2017–2018 Influenza Season on Acute Care Hospitals in the United States: A Qualitative Evaluation of Immediate Responses and Future Preparedness

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Background. The 2017–2018 influenza season was characterized by high illness severity, wide geographic spread, and prolonged duration compared with recent years in the United States – resulting in an increased number of emergency department evaluations and hospital admissions. The current study explored how US hospitals perceived the impact of influenza during this time period, including effects on patient volumes, ways in which hospitals responded, and how lessons learned were incorporated into future influenza preparedness.

Methods. We conducted semi-structured phone interviews with capacity management personnel in short-term acute care hospitals across the United States. A random hospital sample was created using Centers for Medicare and Medicaid Services annual reports. Hospitals self-identified key informants who were involved with throughput and capacity. The interview guide was developed and pilot tested by a team of clinicians and qualitative researchers, with interviews conducted between April 2018 and January 2019. We performed thematic content analysis to identify how hospitals experienced the 2017–2018 influenza season.

Results. We achieved thematic saturation after 53 interviews. Responses conformed to three thematic domains: impacts on staff and patient care, immediate staffing and capacity responses, and future preparedness (Table 1). Hospitals almost universally reported increased emergency department and inpatient volumes that frequently resulted in strain across the hospital. Strain was created by both increased patient volume and staff shortages due to influenza illness. As strategies to address strain, respondents reported the use of new protocols, new vaccination policies, additional staffing, suspected-influenza treatment areas, and more frequent hospital administration meetings. Many hospitals reported increased diversion time. Despite experiencing high levels of strain, some hospitals reported no changes to their future influenza preparation plans.

Conclusion. Acute care hospitals experienced significant strain as a result of the 2017–2018 influenza season. Hospitals implemented a range of immediate responses to seasonal influenza, but generally did not report future planning specific to influenza.