1041. Estimated Hospitalization Rates for Seasonal Influenza in Adults and Children in Middle Tennessee using a Capture-Recapture Method

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Background. Ongoing surveillance of influenza activity is important to monitor variation in disease severity and vaccine effectiveness, but surveillance systems have limitations. The capture-recapture method aims to more comprehensively estimate disease burden by combining data from independent studies.

Methods. Residents of 8 counties in Middle TN hospitalized with influenza during the 2015-16 influenza A(H1N1pdm09)-predominant season were identified using data from 3 independent CDC-sponsored programs. The Influenza Hospitalization Surveillance Network/Emerging Infections Program (FluSurv-Net/EIP) identifies adult and pediatric cases based on a positive clinician-ordered influenza test. The U.S. Hospitalized Adult Influenza Vaccine Effectiveness Network (HAIVEN) and the New Vaccine Surveillance Network (NVSN) enroll adults (3 hospitals) and children (1 hospital), respectively, with respiratory symptoms with/without fever, and obtain nasal/throat swabs to identify cases of influenza; 2015–2016 was a pilot year for HAIVEN. Using the numbers of matched and unmatched cases detected by two studies, a capture-recapture analysis estimated the total number (*N*) of influenza-related hospitalizations in the population (Table 1). Due to small sample size, the Chapman equation was used, where $N = ((a + b + 1)(a + c + 1)/(a + 1)) - 1$. The capture–recapture estimates were adjusted for the hospitals' market share for acute respiratory illness in middle TN residents (69.2% for children and 23.9% for adults) based on hospital discharge data.

Table 1. Sample 2 × 2 table for capture–recapture Analysis HAIVEN or NVSN

FluSurv-Net/EIP	Detected	Missed
Detected	*A*	*b*
Missed	*c*	*z*

a = cases identified by both studies (matches); *b* = cases identified by EIP only; *c* = cases identified by HAIVEN or NVSN only; *z* = estimated number of patients hospitalized with influenza not captured by either study.
$N = a + b + c + z$

Results. Capture-recapture analyses based on unadjusted crude data are shown in Figure 1A and 1B. Age-specific rates of hospitalization were then calculated (Figure 1C).

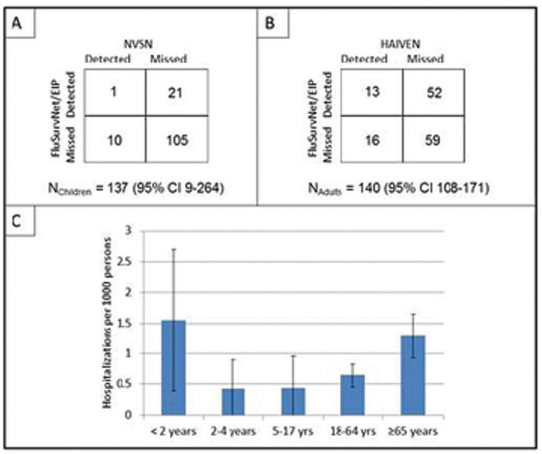

Figure 1:
A. Capture-Recapture Analysis for Pediatric Cases of Influenza (All Children Aged <18 years; unadjusted crude data); B. Capture-Recapture Analysis for Adult Cases of Influenza (All Adults Aged ≥ 18 years; unadjusted crude data); C. Influenza-related hospitalization rates by age group. Error bars indicate 95% Confidence Interval.

Conclusion. Using a capture–recapture method, we estimated influenza hospitalization rates of 0.87 (95% CI 0.06–1.68) and 0.80 (95% CI 0.62–0.98) per 1,000 persons among children and adults, respectively.

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1042. Evaluating the Risk of Viral Myocarditis following Influenza Infection among Hospitalized Patients during 2014–2015 and 2015–2016 Influenza Seasons

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Background. Myocarditis is a severe cardiovascular complication of influenza infection that is often fatal and underdiagnosed. We evaluated the epidemiology of influenza myocarditis (IM) among inpatients at one institution.

Methods. We performed a retrospective cohort study of inpatients harboring influenza virus by reverse transcription-polymerase chain reaction from respiratory specimens between 2014 and 2016. We collected demographic, treatment, strain-typing, and hospitalization data for all patients. Definitive IM was proven by histopathology or viral isolation from myocardial tissue. Probable and possible IM were based on CDC and predefined clinical criteria, respectively. We used the chi-squared test to compare characteristics between 2014–2015 and 2015–2016 influenza seasons and the subset of patients with cardiovascular complications.

Results. We identified 757 patients with influenza in 2014–2015 (n = 453) and 2015–2016 (n = 304). Baseline characteristics including gender, influenza type, and co-morbidities were similar between seasons except for more white and cardiovascular disease (P <0.005) in 2014–2015. Overall, five (0.7%) (2014–2015 = 4, 2015–2016 = 1) had probable IM. Median age was 65 years (range 29–87) and median length of stay was 4 days (range 4–15). All had EKG changes, one had increased heart size without effusion requiring ICU stay and intubation. Four received oseltamivir, and all survived.

Possible IM occurred in 39 patients (5%) based on new EKG changes (58%), troponin elevation (38%) and pericardial effusion (2%). These patients were older (median 81 years, range 29–91) with longer length-of-stay (median 8 days, range 1–41). Oseltamivir was given to 30/39 (77%). Death occurred in 5/23 patients with EKG changes and 3/15 with troponin elevation.

Conclusion. IM was rare during the past two influenza seasons with no attributable mortality at our institution. Eight-fold more patients with IM were detected using a priori criteria when compared with CDC criteria with substantially higher mortality. This may represent a high-risk subset for whom future studies are needed to improve IM diagnosis and prevent morbidity and mortality.

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

1043. Influenza Vaccination and Treatment with Antiviral Agents Among Hospitalized Adults in the 2014–2015 and 2015–2016 Influenza Seasons

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Background. Vaccination and treatment with neuraminidase inhibitors can reduce incidence and severity of influenza. Observational studies suggest antiviral treatment reduces influenza symptom duration and severe outcomes among hospitalized patients. The interaction of the effects of vaccination and antiviral treatment against severe influenza has not been established.

Methods. We used data from a test-negative influenza vaccine effectiveness study. The parent study enrolled adults admitted to two hospitals in Michigan with an acute respiratory illness of ≤10 days duration during the 2014–2015 and 2015–2016 influenza seasons. Respiratory swabs from enrolled patients were tested for influenza by RT-PCR; influenza-positive individuals were included in this analysis. We evaluated predictors of vaccination and antiviral treatment using logistic regression. We also assessed the association between antiviral treatment and hospital length of stay (LOS) using linear regression models stratified by vaccination status.

Results. We included 200 individuals in the analysis; 103 (51.5%) were vaccinated and 135 (67.5%) were treated with antivirals. Significant predictors of vaccination included age ≥65, white race, a Charlson comorbidity index (CCI) score ≥3, study site, and increased past-year health care visits. Antiviral treatment varied by study site and was more common in the 2015–2016 season and among those aged 18–49. Vaccination was not associated with antiviral treatment or with time from illness onset to treatment. Antiviral treatment was associated with reduced LOS (percent change in LOS: −23.6% (−39.2%, −4.1%), P = 0.02) among vaccinated participants but not among unvaccinated participants (21.1% (−10.9%, 64.8%), P = 0.22) after adjustment for sex, age, influenza subtype, site, CCI, frailty, and past-year health care contacts. When an interaction term was used in lieu of stratification the interaction was significant (P = 0.01). This difference in antiviral effectiveness by vaccination status held across age groups, but was most dramatic for those aged 18–49.

Conclusion. Vaccinated individuals were more likely than unvaccinated individuals to benefit from antiviral treatment. This finding warrants confirmation in other populations.

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1044. Active Surveillance to Quantify the Burden of Norovirus in a U.S. Veterans Affairs (VA) Patient Population, Houston, 2015–2016

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Background. Norovirus is the leading cause of acute gastroenteritis (AGE) outbreaks in the United States; however, little data exist on the burden of endemic norovirus disease among adults. Robust estimates of the norovirus disease burden among US adults are needed to inform assessment of potential norovirus vaccines, which are currently in development.

Methods. We conducted active surveillance for AGE at the Michael E. DeBakey Veteran's Affairs (VA) Medical Center, where approximately 104,000 unique patients were served in 2016. Cases were defined as veterans with symptoms of AGE (≥3 loose stools, ≥2 vomiting episodes, or ≥1 episodes of both loose stool and vomiting, within 24 hours) occurring in the previous 10 days, who presented to the emergency department or outpatient clinics (outpatients), or were admitted to the hospital (inpatients). Patients without AGE symptoms in the prior 14 days were enrolled as controls. Demographic data and illness characteristics were collected from enrolled subjects, and stool samples were collected and tested using the FilmArray gastrointestinal panel. Norovirus positives were confirmed by real-time RT-PCR and genotyped after sequencing of conventional PCR products.

Results. From November 1, 2015–November 30, 2016, 130 inpatient and 85 outpatient AGE cases, along with 20 inpatient and 37 outpatient controls, were enrolled and provided a stool specimen. Among cases, 201 (93%) were male, and 94 (44%) were ≥65 years; median duration of illness was 3 days (range, 1–10 days). Norovirus was detected in 12 (9%) inpatient and 15 (18%) outpatient cases; norovirus was not detected in any controls. Incidence of norovirus-associated hospitalization was 15/100,000 population, and was similar in hospitalized cases aged <65 years (14/100,000) and ≥65 years (15/100,000). Of 22 norovirus positive specimens genotyped, 13 (59%) were GII.4 Sydney.

Conclusion. This robust, active surveillance platform employed screening and enrollment of patients in a VA population meeting a standardized AGE case definition, as well as asymptomatic controls. Data from this study highlight the burden of norovirus in adults and importance of a norovirus vaccine.

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1045. Norovirus, Astrovirus, and Sapovirus in a Tertiary Care Research Hospital

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Background. Norovirus, astrovirus, and sapovirus are known to cause acute gastroenteritis and are associated with chronic viral excretion in stool among immunocompromised patients. Because molecular tools for their detection only recently became widely available, the prevalence and chronic excretion of these viruses has not been well defined. We describe features of these viral infections among patients receiving care at the Clinical Center of the National Institutes of Health.

Methods. We identified patients with a positive BioFire FilmArray® gastrointestinal panel result for norovirus, astrovirus, or sapovirus from September 15, 2015 through November 30, 2016. We reviewed patient medical records to abstract clinical and microbiologic information. Chronic excretion was defined as more than one positive test for a given virus with more than 30 days between tests.

Results. Of 932 samples tested, 102 (11%) samples from 48 patients tested positive for norovirus, 15 (2%) samples from 11 patients tested positive for sapovirus, and 16 (2%) samples from 7 patients tested positive for astrovirus. One of these patients had a sample that tested positive for both sapovirus and norovirus, and one tested positive for astrovirus and sapovirus at separate points during the study period. Of the 48 patients with norovirus, 16 (33%) had evidence of chronic excretion, with a median duration of 189 days (range 72–372). Of these 16, 14 were known or suspected to be immunodeficient, and 4 had hematologic malignancies. Of 7 patients with astrovirus, 1 (14%) had evidence of chronic excretion (132 days). This patient had a hematologic malignancy and was taking immunosuppressive medication. No patients with sapovirus had evidence of chronic excretion. Overall, 20 (31%) patients additionally tested positive for another gastrointestinal pathogen, most commonly enteropathogenic *E. coli* and *C. difficile*.

Conclusion. Norovirus remains common in this immunocompromised patient population, and both sapovirus and astrovirus are present. Additional follow-up in this and other cohorts with new molecular tools will enable more complete description of the prevalence, excretion duration, and clinical features of infection with these enteric viruses.

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1046. Incidence of Norovirus-Associated Acute Gastroenteritis in Four Veteran's Affairs Medical Center Populations in the United States, 2011–2015

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Background. In the USA, norovirus is an important cause of epidemic acute gastroenteritis (AGE) as well as a leading cause of pediatric AGE. However, the burden of sporadic norovirus disease in US adults has not been well-documented. Our objective was to estimate the incidence of outpatient visits and hospitalizations for community-acquired norovirus AGE at four Veterans Affairs Medical Centers (VAMCs) and their associated outpatient clinics in Atlanta, GA; Bronx, New York; Houston, TX; and Los Angeles, CA.

Methods. From November 2011 to September 2015, stool specimens collected for clinician-requested diagnostic testing within 7 days of AGE symptom onset and with reported vomiting or diarrhea were tested for norovirus by real-time RT-PCR and positive samples were genotyped by Sanger sequencing. Incidence of norovirus-associated outpatient visits and hospitalizations were calculated by multiplying the prevalence of norovirus among tested specimens by AGE-coded outpatient encounters and inpatient discharges, and dividing by the unique patients served at each VAMC.

Results. 1,620 stool specimens were tested from all 4 sites. Seven percent of outpatient (n = 795) samples (annual range: 3%–10%; range by site: 3%–10%) and 6% of (n = 825) samples from hospitalized patients tested positive for norovirus (annual range: 3%–8%; range by site: 3%–10%). Forty-four percent of norovirus-positive specimens were typed as GII.4 Sydney. Seventy-four percent of norovirus-positive specimens were collected between November and April. From 2011 to 2015, outpatient norovirus incidence was 250/100,000 population (annual range: 129 to 426/100,000; range by site: 87 to 428/100,000), and the incidence of norovirus hospitalizations was 28/100,000 population (annual range: 19 to 39/100,000; range by site: 14 to 57/100,000). By age group and setting, the highest incidence was observed among 45- to 64-year-old outpatients (370/100,000 population), and 85+-year-old inpatients (63/100,000 population).

Conclusion. This study provides estimates of the incidence of norovirus AGE outpatient visits and hospitalizations across multiple years among a geographically distributed VA population, highlighting the substantial burden of norovirus in US adults.

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1047. WU Polyomavirus Associated with Severe Respiratory Failure in Children

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Background. WU polyomavirus (WUPyV) is a relatively new virus associated with respiratory infections. However, its role is unclear in children with severe