

## 37 Emergency Department Hospitalization Practices for Community-Acquired Pneumonia Encounters: Validating CURB-65 for Discharged Patients

Sharp AL, Gould MK, Jones J, Wu I, Huynh D, Kocher KE, Shah NR/Kaiser Permanente Department of Research and Evaluation, Pasadena, CA; Kaiser Foundation Health Plan, Pasadena, CA; Downey Medical Center, Kaiser Permanente, Downey, CA; Orange County Medical Centers, Kaiser Permanente, Anaheim, CA; University of Michigan, Ann Arbor, CA

**Study Objective:** Pneumonia accounts for over 1.2 million US hospitalizations annually resulting in \$10.2 billion in health care costs. Unnecessary hospitalizations put patients at risk and strain the limited resources of an already taxed medical system. Currently, tools to assess pneumonia severity have limited applicability to emergency department (ED) disposition decisions because they were developed using only data from patients admitted to the hospital. This study describes current ED admission practices for patients with community-acquired pneumonia (CAP) based on the CURB-65 severity index, and reports on CURB-65's ability to predict 30-day mortality for a cohort of patients discharged and hospitalized from the ED.

**Methods:** A retrospective, observational study of all adult CAP encounters in 14 community EDs from July 2009 to June 2012. We calculated CURB-65 scores based on the established severity scoring system (0-5) to describe all encounters, as well as stratified by those hospitalized and discharged. Each score was used as a cut-off to calculate sensitivity, specificity, positive predictive value, and negative predictive value for predicting 30-day mortality. We described the use of hospitalization for ED CAP encounters and identified discharged patients returning for admission within 7 days.

**Results:** The sample included 21,183 ED encounters for CAP (7,952 discharged and 13,231 admitted). The C-statistic describing the accuracy of CURB-65 at predicting 30-day mortality in the full sample was 0.761 (95% CI, 0.747-0.774). Among patients discharged from the ED it performed better (0.864, 95% CI, 0.821-0.906) than for those admitted from the ED (0.689, 95% CI, 0.672-0.705). Among all encounters a CURB-65 threshold  $\geq 1$  was 92.8% sensitive and 38.0% specific with a 99.0% NPV. Among all encounters, 62.5% were admitted, 36.2% of those at lowest risk (CURB-65=0). Overall, discharged CAP patients had a 5.7% chance of returning for hospital admission within 7 days of the encounter. When stratified by CURB-65 score, 4.2%, 7.7%, 7.5%, and 12.8% were hospitalized within 7 days for scores 0-2 and  $\geq 3$  respectively. If a low-risk threshold of CURB-65  $\leq 1$  had been the only factor used to determine ED discharge vs. admission, then only 34.3% of patients (versus 62.5%) would have been hospitalized. This would have avoided 6,936 (52.4%) of our observed low-risk admissions, and conversely increased admissions for high-risk (CURB-65  $\geq 2$ ) by 970 admissions (7.3%), resulting in a net decrease of 5,966 (45.1%) hospitalizations.

**Conclusion:** CURB-65 has very good accuracy for predicting 30-day mortality for patients with CAP discharged from the ED, even better than previous reports of hospitalized cohorts (C-statistic 0.87 vs 0.80). This severity tool may be used when assessing ED patients with CAP to assist providers and patients with disposition decisions. Discharging the lowest risk patients could provide substantial savings to the US health system while maintaining acceptable patient safety.

## 38 The Relationship Between Emergency Department Utilization and Health Care Professional Referrals

Fertel BS, Podolsky SR, Hart KW, Powell L, Jennings M, Mace SE/Cleveland Clinic Foundation, Cleveland, OH; University of Cincinnati, Cincinnati, OH

**Study Objectives:** The expansion of health care coverage has increased discussions about inappropriate emergency department (ED) utilization. Little is known about the ED referral patterns of patients by health care professionals (HCP) [physician office clinic, on-call hotline, or nurse on-call] and the appropriateness of the referral by the HCP or the appropriateness of patient self-referral among those with and without a primary care provider (PCP). We sought to determine whether ED patients contacted a HCP prior to ED presentation or if they self-referred as well as ascertain whether there were any differences in admission rates (hospital or ED observation unit) between HCP referred and self-referred patients.

**Methods:** This was a convenience sample of patients who presented to an urban, academic, tertiary care ED of a large integrated health system. Patients were enrolled in June 2014 by trained research assistants present in the ED during the business hours of local clinics/offices (Monday through Friday, 8a-5p). Inclusion criteria were English speaking, non-psychiatric patients >18 years of age, willing to consent, and not pregnant or critically ill. A standard survey form was used to record whether patients had a PCP and were referred by a HCP for their presenting problem. Information

about acuity, demographics, and disposition were obtained from the electronic medical record (EMR). All analysis was descriptive.

**Results:** There were 672 patients who met inclusion criteria, and 511 (76%) consented. Mean age was 53 (SD 19), 57% were female and 50% were black. Overall, 242/511 (47%) reported contacting a HCP prior to their ED visit and 202/242 (83%) were referred by the HCP to the ED. Of these, 106/202 (53%) were admitted, compared to 90/309 (29%) of self-referred patients. The majority (95%) of HCP referred patients had an emergency severity index (ESI) of 2 or 3, compared to 74% in self-referred patients. There were 40/242 (17%) patients who contacted a HCP and were not referred to the ED, yet who subsequently self-referred. Of these, 12/40 (30%) were admitted. Most patients, 414/511 (81%) reported having a PCP. Of these, 215/414 (52%) contacted a HCP prior to the ED visit and 183/414 (44%) were referred by the HCP to the ED. Of those without a PCP, 27/97 (28%) contacted a HCP prior to the ED visit, 19/27 (70%) were referred to the ED, and 8/27 (30%) were not referred, and subsequently self-referred. Patients with a PCP had an admission rate of 43% compared to 19% in those without. Of those with a PCP, 73% of HCP-referred patients and 68% of self-referred patients saw a HCP within the past 3 months.

**Conclusion:** In this study conducted when outpatient clinics were open, nearly one-half of all patients contacted a HCP prior to their ED visit. Importantly, almost one-third of patients without a PCP also contacted a HCP prior to their ED visit. Based on admission rates and acuity it appears that HCPs appropriately refer to the ED; however, some patients should have been referred and were not. It is unlikely that these patients could have been treated in an alternate venue such as a walk-in clinic or PCP office. Despite popular sentiment to the contrary, many ED patients (with and without a PCP) attempt to use available resources prior to ED presentation. In addition, when indicated, patients appropriately seek timely emergent care unavailable in other settings. ED patients belong in the ED.

## 39 Withdrawn

## 40 An Emergency Department-Based Community Health Worker and Care Coordination Intervention for Frequent Emergency Department Users

Lin MP, Goldner JS, Higgins ML, Lessenich EM, Schuur JD/Brigham and Women's Hospital, Boston, MA

**Study Objectives:** Care coordination and community health worker interventions for frequent emergency department (ED) users are well studied in primary care settings, but less prevalent in EDs. We evaluated a quality improvement intervention to improve care coordination and reduce ED visits and hospitalizations among frequent ED users.

**Methods:** We developed an ED-based care coordination program for frequent ED users. We identified 72 patients with the most frequent ED use over the preceding year and preceding 3 months. We randomly assigned 36 patients to intervention and 36 to usual care. The intervention included (1) developing acute care plans that were easily identified on the electronic health record, and (2) hiring a community health worker to assist with social services and navigating care. Outcomes were: (1) ED visits, (2) hospitalizations (inpatient or observation), (3) expenditures (direct cost), (4) hospital revenue (payments), and (5) net margin. We calculated hospital revenue and expenditures related to ED visits, observation and inpatient hospitalizations, using hospital financial data and report proportional changes. We subtracted expenditures from revenue to calculate net margin. We analyzed the program effect for the 4 months post-intervention compared to the 9 months prior to intervention and standardized all numbers to represent visits and cost per patient per month (PPPM). We used an intention-to-treat analysis, including patients assigned to intervention regardless of whether they received services (some were difficult to contact or declined), but excluded 15 patients who had zero costs in the follow-up period (2 moved, 4 died, others transferred care, 9 intervention and 6 control). We calculated program effect using a difference-in-differences approach.

**Results:** The average cost of care for all patients (control and intervention) in the pre-intervention period was \$4,195 PPPM. Among the usual care group, ED visits decreased but hospitalizations increased. Both ED visits and hospitalizations decreased in the intervention group. The program effect (difference in differences) was 0.18 fewer ED visits and 0.44 fewer hospitalizations PPPM in the intervention group compared to the control group. Revenue and expenditures increased in the control group, while revenues and expenditures decreased among the intervention group. The program was associated with reductions in direct costs (-37%), hospital revenues (-59%), and with an increase in net margin (+99%) in the treatment group compared to the usual care group PPPM. Other results are in the Table. These correspond to a total annualized

net contribution margin of \$275,449. Based on an annual program cost of \$63,000, the program's return on investment was 3.4. A sensitivity analysis showed a larger program effect if all patients were included.

Conclusions: An ED-based program to create acute care plans and engage a community health worker with frequent ED users is promising to reduce ED visits and hospitalizations. Our pilot program produced savings to the health care system and to the hospital. Further investigation is needed to determine long-term effects and impact on quality.

Effect on ED Visits, Hospitalizations (Per Patient Per Month)

	# ED visits (PPPM)	# Hospitalizations (PPPM)
Control (Pre)	0.91	0.59
Treatment (Pre)	0.93	0.68
Control (Post)	0.85	0.72
Treatment (Post)	0.68	0.37
Change in Control Group	(-0.06)	0.13
Change in Treatment Group	(-0.25)	(-0.31)
Program Effect (Difference in Differences)	(-0.19)	(-0.44)

Hospitalizations include inpatient and observation. Negative values are in parentheses.

## 41 Pilot Study of Telemedicine in a County Jail to Assess and Treat Acutely Ill Inmates

Vilke GM, Guss DA/University of California San Diego, San Diego, CA; UC San Diego, San Diego, CA

Background: Providing health care to inmates in county jails and state prisons is very challenging. Beyond the diverse medical issues encountered, there is often limited access to high quality practitioners, serious security concerns and costs related both to provision of care onsite and transfer to community medical facilities.

Study Objective: To assess the feasibility of a remote physician and onsite nurse to provide acute assessment and care to inmates in a county jail via telemedicine.

Methods: This was a prospective convenience pilot study. It was conducted at a large county jail that operates an onsite medical unit with 24-hour nursing care, day time medical clinics and a post hospitalization care unit. Physicians are onsite between 8 am and 5 pm and available for phone consultation after hours. After 5 pm inmates with acute medical problems can be sent to a local community emergency department (ED) for evaluation and treatment before or after physician phone consultation. During the period of the pilot study an on-call physician could be contacted at the discretion of the onsite nurse to conduct an evaluation of inmates via telemedicine in lieu of immediate transport to the ED. The telemedicine unit provided for real time two-way high resolution audio and visual communication. The unit was equipped with peripherals that permitted otoscopy, auscultation and very high resolution imaging via a hand-held camera. All communication was over an encrypted network. Data collected included chief complaint, final diagnosis, telemedicine examination, action taken which included onsite treatment and disposition either transport to the ED or kept onsite. All patients had follow-up the next day at the onsite jail medical clinic.

Results: During the study period 6 inmates were assessed via telemedicine. Two patients had closed head injury associated with scalp lacerations, 1 had acute left eye pain and redness, 1 had acute right eye pain and redness, 1 had a self-inflicted slashing wound to the neck, and 1 had blunt facial trauma and laceration. Four inmates were treated onsite after telemedicine physician assessment and 2 were sent to the ED for evaluation and treatment. Physician determination was that all patients would have been emergently transported to the ED if telemedicine was not available. Both patients with head injury and scalp laceration and the patient with facial trauma and laceration were treated onsite with tissue adhesive for the laceration and nursing neurological checks until with follow-up in sick call clinic. The patient with eye pain and redness was managed onsite after evaluation identified a small ocular foreign body and corneal abrasion. The patient with self-induced neck wound and the patient with right eye redness and pain were sent to the ED. All patients had uneventful outcomes.

Conclusion: This limited pilot study demonstrated the utility and safety of physician evaluation of inmates with potentially serious chief complaints via telemedicine. Four of 6 patients were able to avoid ED transfer with its attendant costs and security concerns. Based upon this pilot a larger study is warranted.

## 42 Impact of a Novel Volunteer-Run Discharge Planning Program on Follow-Up Appointment Adherence

Shung D, Lin J, Chou A, Heberlig S, Medford-Davis L, Siler-Fisher A/Yale University School of Medicine, New Haven, CT; University of San Francisco School of Medicine, San Francisco, CA; Baylor College of Medicine, Houston, TX; Rice University, Houston, TX; Robert Wood Johnson Clinical Scholars Program, University of Pennsylvania Perelman School of Medicine, Philadelphia, PA; Baylor College of Medicine, Houston, TX

Study Objectives: The reported adherence rate with follow-up appointments after emergency department (ED) discharge has ranged from 20-48%, and nonadherence has been associated with lack of insurance. Failure to follow-up is linked to poorer patient outcomes in patients with chronic conditions such as congestive heart failure. Other case-management interventions utilizing dedicated hospital staff have shown significant improvements in primary care follow-up rates. We assessed the effect of a volunteer-run discharge planning program on adherence to provider ordered follow-up appointments after emergency department discharge in an academic public hospital.

Methods: A quasi-experimental trial was performed to measure the effectiveness of volunteer college students connecting discharged patients to an established system of outpatient community clinics. Enrollment alternated between discharge-as-usual and volunteer-assisted discharge. Volunteers helped case patients apply for social services and a financial assistance program for health services, and called patients after discharge to remind them of their follow-up appointments. Fisher's exact and Chi-squared univariate tests were performed followed by a multivariable regression to determine the impact of volunteer-assisted discharge on attendance at follow-up.

Results: Of the 342 patients enrolled in the study between February 2013 to March 2014, 141 were referred for follow-up. 60% (44) of cases and 49% (39) of controls attended their scheduled follow-up appointments ( $P = .20$ ). When analysis was restricted to patients who held insurance prior to intervention, 73% (38) of the cases and 53% (29) of the controls attended the appointments, a result which trended toward significance ( $P = .06$ ). A higher percentage of patients made appointments when they had received a follow-up call (70% vs 56%), but only 20 of 140 patients were actually reached by phone to receive the reminder to attend their follow-up. On multivariable analysis males were significantly less likely (OR 0.33, 95% CI 0.15-0.67) and medical insurance holders were significantly more likely (OR 3.67, 95% CI 1.61-8.75) to attend an ordered follow-up appointment ( $P < .01$ ). Having an established PCP, a car, or higher income were not associated with increased attendance at follow-up, nor was speaking English as a primary language.

Conclusion: There was a nonsignificant increase in follow-up appointment attendance for patients who were assisted by the volunteers. Having medical insurance was found to be significantly associated with outpatient follow-up in both cases and controls. Among patients with insurance, those who underwent the intervention were more likely to attend outpatient follow-up, which may indicate that these interventions are most powerful in patients with financial access to health care. With the expansion of insurance coverage, non-medical volunteers are an innovative approach to improve ED patient outcomes.

## 43 Describing the Evolution of Mobile Technology Usage for Latino Patients and Comparing Findings to National Mobile Health Estimates

Ford K, Burner E, Terp S, Lam CN, Menchine M, Arora S/USC Keck School of Medicine, Los Angeles, CA

Study Objectives: Mobile Health (mHealth) has been used to improve health, and prior studies show Latinos in the United States desire mHealth solutions. A 2010 Pew Research Center Report stated that Latinos use text messages, instant messaging, applications, email, and mobile internet at rates similar to non-Latino counterparts. However, in 2012 our group reported that Latino patients seen at a large safety-net system use mobile phone functions at significantly lower rates. The objective of this investigation was to describe the change in mobile technology use by an urban Latino population between 2012 and 2014, and to compare findings with best available national estimates.

Methods: A consecutive sample of patients from the ED and three county-sponsored medical clinics at LAC+USC Medical Center were surveyed in two waves: July to August 2012 and July to August 2014. Trained RAs administered questionnaires including items on demographics, medical history, and personal mobile technology use of differing functions on their phones. Patients who self-identified as Latino were retained for analysis. Using chi-squared tests, data from 2012 and 2014 were compared with the 2010 Pew Report on proportions of cell phone ownership and other mobile phone functionalities. We also aggregated data from the two survey waves and completed analyses of the specific areas of mobile health capacity stratified by presence or absence of chronic disease, age, language preference, and educational attainment using chi-squared tests.